

7. APPENDIX A

- 1. CALTRANS MEMO TO DESIGNERS 3-7**
- 2. STANDARD PILE DATA FORM**



3-7

DESIGN DATA DOCUMENTATION AND EVALUATION OF ANOMALOUS CONCRETE SHAFTS

Introduction

Cast in Drilled Hole (CIDH) Shafts (also known as CIDH Piles), and Cast in Steel Shell (CISS) concrete piles are commonly used when large vertical or lateral resistance is required. When ground water is anticipated drilled shafts must be at least two feet in diameter and must be inspected by Gamma-Gamma Logging (GGL), and may require inspection by Cross-Hole Sonic Logging (CSL). Memo to Designers 3-1 (MTD 3-1) provides guidelines for the required number of inspection pipes and the proper placement of the pipes to improve constructability. MTD 3-1 requirements for placement of inspection pipes may require the designer to use bundled bars or increase the size of the shaft. Communications with Structure Construction and Geotechnical Services during design and CIDH pile pre-construction meeting will improve shaft constructability and may prevent costly delays and anomaly mitigations.

The Foundation Testing Branch (FTB) of Geotechnical Services performs GGL and CSL on CIDH piles together with other Quality Assurance (QA) procedures. The main objective of GGL is to investigate uniformity of concrete density, where significant reduction in density identifies anomalies. CSL is used to assess integrity of concrete and detect presence of voids or anomalies. GGL is the primary test in Caltrans, and CSL is used as a complement to provide more detailed information about location and size of the anomaly. When defects are detected Structure Design (SD), Geotechnical Services (GS), and Corrosion Technology Branch of Materials Engineering and Testing Services (METS) are contacted. Considering short timeframe requirements specified in the Construction Standard Specifications, the information required for structural evaluation of a potential anomaly should be prepared during the design phase. This memo provides guidelines for documentation of the design data and location to be retained, the structural evaluation process of rejected shafts, and an example to clarify the process.

CIDH Shaft Design Data Documentation

If slurry displacement method is used to construct CIDH shafts, the FTB will perform non-destructive testing to evaluate homogeneity of the concrete shaft. When the testing detects an anomaly the shaft is rejected. Structure Construction collects design information from



GS, SD and Corrosion Technology Branch to evaluate the rejected shaft. Gathering this information is required to determine if the shaft is "adequate" or "inadequate" with the anomaly in place.

Structural evaluation must be completed within the timeframe specified in the contract's documents, or the State may incur costs associated with delays. To prevent such delays, the Project Engineer or DES Liaison/Oversight Engineer shall compile the necessary design information for each CIDH pile during the Plans, Specifications & Estimate (PS&E) phase of the project. The information shall be checked and retained in the project files and must be easily accessible during the construction phase. Furthermore, the SD Branch Chief or Consultant Structure Lead (or Structure Project Manager) will verify that information is complete, and will complete and sign the Shaft Design Information Form, as shown in Attachment 1 (Figure 1 for Caltrans Designed Projects; Figure 2 for Consultant Designed Projects, whichever is applicable). The form is forwarded to Structure Construction, Resident Engineer's (RE) Pending File as a part of Structures Plans, Specifications, and Estimates (SPS&E) package.

Design information to be retained and required for evaluation generally include "Factored Shear Force and Bending Moment Diagrams" along the pile length, shear and moment capacities assuming no anomaly is present, and electronic input files (such as X-Section files) for capacity calculations. The designer will need to envelope the maximum shear, moment, and axial demands that may occur during the life of the structure for different limit states, construction stages, and also combinations of scour and liquefaction (if applicable). This information will be saved in the design branch for the construction support phase as stated above. Shear and flexural capacities of the defective shaft are also required for structural evaluation. However, this portion cannot be completed until the location and size of the anomaly (if any) is known.

Pile Design Data Form

After the contractor has constructed a CIDH-concrete pile using the slurry displacement method, the FTB will perform California Test Method (CT) 233 – "Method for Ascertaining the Homogeneity of Concrete in CIDH Piles Using the Gamma-Gamma Test Method." If acceptance testing performed by the engineer determines that a shaft does not meet the requirements of the specifications of CTM 233, Part 5C, then the shaft will be rejected.

After the shaft has been rejected, the State has a limited amount of time to make a determination on which of the following options is available to the contractor for dealing with the rejected shaft:



- 1) The shaft must be supplemented or replaced.
- 2) The shaft must be repaired.
- 3) The shaft is adequate with the anomaly left in place.

Pile Design Data Form (PDDF) is used to collect information from various units of the Division of Engineering Services (DES) to determine if anomaly needs to be repaired. The FTB will complete Part 1 of the PDDF (see Attachment No. 2 of Bridge Construction Memo 130-10). This information will identify the severity and the location of the anomaly within the shaft and will be used by GS to complete Part 2, SID to complete Part 3, and the Corrosion Technology Branch to complete Part 4 of the form. Structure Construction concludes the evaluation process by completing Part 5 of the form.

The following information is required for structural evaluation and to complete Part 3 of the form (Structural):

- a) The reduced shear and moment capacities of the defective shaft at the location(s) of the anomaly. This step will be explained in the Example of Evaluation Process illustrated in this Memo.
- b) The shear and moment demands at the location of the anomaly. This information should be readily available to the Structure Design personnel conducting construction support, since it may be time consuming to reproduce this data.
- c) Determination if the shaft is structurally adequate with the anomaly left in place. Structure Design will make this determination using the information above and engineering judgment considering uncertainty in the nature of the anomaly. It is important to point out that the evaluation process must be completed within the time frame specified in the contract.

If the shaft is determined to be adequate with the anomaly in place, then the contractor may choose to repair the shaft and receive full payment or leave the anomaly and incur an administrative deduction specified in the contract. If the shaft is determined to be inadequate, then the anomaly mitigation process will start. BCM 130-12 provides detailed information regarding the mitigation process and methodology.

Structural Evaluation of Anomalous Shafts

In general, structural evaluation of the shaft at the anomaly location includes comparing reduced bending, shear and axial capacities to corresponding Strength and Extreme Event (seismic) demands. However, for shaft groups in competent soil, limited bending is developed in the shaft. Therefore evaluation will be limited to axial and shear capacity checks.



The evaluation should be performed with and without scour and liquefaction effects, if applicable. Therefore, up to four different combinations must be considered. In the design phase, the location of the potential anomaly is unknown; therefore, demands for all applicable cases must be compiled and recorded as moment and shear diagrams or tables for the entire length of the shaft. Factored axial load, which is equivalent to factored nominal compression resistance of the shaft, can be easily extracted from the Pile Data Table.

GGL results identify the pipe(s) with unacceptable low concrete density reading(s); therefore, designer may conservatively eliminate the tributary slice(s) corresponding to pipe(s) with low reading(s). CSL results may provide more detailed information about the size of the anomaly and will improve strength evaluations. Following is a summary of the typical structural evaluation process:

Flexural Capacity Calculations

Use sectional analysis software (such as X-Section Program) to calculate the flexural capacity of the anomalous shaft (M_m or M_p , that is expected nominal moment or plastic moment of the section, respectively). Modeling assumptions will depend on the type of the testing as summarized below.

GGL results: When GGL detects unacceptable low readings in a single pipe or multiple adjacent pipes, the corresponding tributary slice(s) will be assumed to be a void (without concrete and rebar), and flexural capacity will be calculated in a direction that causes compression in the lost slice(s) of the section. When multiple non-adjacent pipes show unacceptable low readings, flexural capacity must be assessed in different directions (30 degree intervals), and the minimum value will be used.

CSL results: The approximate size and location of the anomaly detected by CSL will be assumed to be a void, and the flexural capacity of the cross section will be calculated in different directions (30 degree intervals) and the lowest capacity will be used.

Evaluation for Bending and Shear

Considering approximations in assessing the size of the anomaly, acceptance criteria for bending and shear under the Extreme Event (seismic) Limit State is as follows:

Type-II Shafts

GGL results: The moment and shear checks are summarized as:

$$M_d \leq M_m^R \text{ and } V_d \leq \phi V_n^R$$



CSL results: The moment and shear checks are summarized as:

$$M_d \leq 0.8M_{nr}^R \text{ and } V_d \leq \phi V_n^R$$

where M_d and V_d are seismic moment and shear demands at the location of the anomaly when applying over-strength moment (M_o) at the column base. M_{nr}^R is the expected nominal moment of the reduced cross section of the shaft at the location of the anomaly, and ϕV_n^R is the factored nominal shear resistance of the reduced cross section of the shaft as defined in Caltrans' Seismic Design Criteria (SDC 3.6.7). In calculating shear resistance of concrete, the cross section of the shaft is reduced in proportion to the size of the anomaly (V_n^R). Since the detected anomaly indicates concrete with lower density rather than a void, the shear reinforcement is assumed functional when calculating V_n^R . This simplified approach for calculation of V_n^R is limited to shallow anomalies, where thickness of the anomaly (measured along the shaft) is less than half of the diameter of the shaft. For deeper anomalies, special analysis is required to determine V_n^R contribution to shear resistance of the shaft. The shear resistance of permanent steel casing or shell can be included in shear capacity calculations, irrespective of the thickness of the anomaly.

Type-I Shafts and CIDH Pile Groups in Liquefied Soil (if plastic hinges form in the shafts)

GGL results: Seismic moment demand (M_d) at the location of the anomaly should be less than $1.25 M_p^R$ for multi-column bents and $1.15 M_p^R$ for single column bents. M_p^R is the plastic moment of the reduced shaft cross section at the location of the anomaly. Seismic shear demand at the location of the anomaly (V_n^R) shall be less than the nominal shear resistance of the pile (ϕV_n^R), as defined in SDC 3.6.1. In calculation of shear resistance of concrete (V_n^R), the cross section of the shaft is reduced in proportion to the size of the anomaly. However, contribution of shear reinforcement (V_s) is not reduced. This simplified approach for calculation of V_n^R is limited to shallow anomalies, where depth of the anomaly is less than half of the diameter of the shaft. For deeper anomalies, more refined analysis is recommended.

CSL results: Seismic moment demand (M_d) at the location of the anomaly should be less than M_p^R . The shear check will be the same as the GGL case.

Evaluation for Compression

For both GGL and CSL testing, factored nominal compression resistance of the shaft at the anomaly location is checked based on the reduced cross sectional area of the shaft along with Load and Resistance Factored Design (LRFD) Specifications and California Amendments, as follows:

$$P_u \leq \phi P_n^R$$



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Where $\phi = 0.75$, $P_n = 0.85[0.85 f'_c (A_g - A_s) + f_y A_s]$, and P_p^R is calculated by reducing P_n in proportion to the number of pipes with unacceptable low readings

Refer to LRFD BDS (5.7.4.4) for definition of terms. Factored resistance must be checked against factored loads for Strength Limit State load combinations.

Attachment 2 provides an example of the evaluation process for a Type-II shaft with anomalies detected by both GGL and CSL. Attachment 3 is the PDDF of the example with design information added after structural review.

References

Bridge Memo to Designers 3-1, Deep Foundations, Office of Structure Design, Division of Engineering Services, California Department of Transportation, Sacramento, CA, July 2008.

Bridge Construction Memos 130-10.0 and 130-12.0, Bridge Construction Records and Procedures Manual, Office of Structure Construction, Division of Engineering Services, California Department of Transportation, Sacramento, CA, 2007.

Seismic Design Criteria, Version 1.6, Office of Earthquake Engineering, Division of Engineering Services, California Department of Transportation, Sacramento, CA, 2010.

AASHTO LRFD Bridge Design Specifications, 4th Edition with 2008 Interims, AASHTO, Washington, D.C., 2007.

California Amendments to *AASHTO LRFD Bridge Design Specifications*, California Department of Transportation, Sacramento, CA, 2008.

Original signed by Barton J. Newton

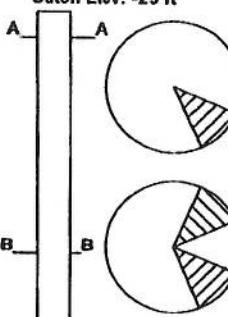
Barton J. Newton
State Bridge Engineer
Deputy Division Chief, Structure Policy & Innovation
Division of Engineering Services



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ATTACHMENT 3

3-7 PILE DESIGN DATA FORM (GGL)

1 Foundation Testing		Name GS-FTB Phone: _____ Date: _____
Anomaly Overview		
Testing Performed <input checked="" type="checkbox"/> GGL <input type="checkbox"/> CSL		
Shaft Diameter: 8 ft		
Cutoff Elev.: -29 ft		
		
Section A-A Elev.: -32 ft to -34 ft Up to 12.5% Affected		
Section B-B Elev.: -65 ft to -67 ft Up to 25% Affected		
Tip Elev.: -113 ft		
Anomaly Description		
Section A-A: Anomaly was detected in one (1) GGL inspection tube. May affect up to 12.5% of Shaft cross-section at this location.		
Section B-B: Anomalies were detected in two (2) GGL inspection tubes. May affect up to 25% of Shaft cross-section at this location.		
4 Corrosion		Name: METS Phone: _____ Date: _____
Consideration is <input type="checkbox"/> Required <input type="checkbox"/> Not required		
<i>For anomalies between the top of pile and 3 feet below the lowest estimated groundwater level at the site, corrosion results listed in the Geotechnical report are used to assess the need for repair. For situations where results are not available, soil samples may be obtained adjacent to the anomaly and tested in accordance with California Test (CT) 643 (Parts 2, 3 and 4) and if necessary, CT 417 and CT 422 to determine soil corrosivity. For anomalies outside these limits, and where no stray current source can be identified or for non-corrosive soil conditions, no consideration of corrosion potential is required</i>		
Corrosion Potential at Section A-A: _____		
Corrosion Potential at Section B-B: _____		
5 Construction Considering parts 2-4 of this form.		Structure Rep.: SC Phone: _____ Date: _____
Sec. A-A is: <input type="checkbox"/> Acceptable with Administrative Deduction		<input type="checkbox"/> Unacceptable, Mitigation is Required
Sec. B-B is: <input type="checkbox"/> Acceptable with Administrative Deduction		<input type="checkbox"/> Unacceptable, Mitigation is Required
Bridge: Dist-Co.-Route: Structure Rep:	Bridge No.: EA: Phone:	Abt./Bent. Pile: Fax:

APPENDIX B

SE CONNECTOR, BR. NO.56-802F (ID-10) BACKUP DOCUMENTATION

1. Designer's Structural Assessment Memo
2. 'X-section' program run output for Bent 15 pile
3. Additional As-built plans

Memorandum

*Flex your power!
Be energy efficient!*

To: BARTON NEWTON
Deputy Division Chief
Structure Policy and Innovation
State Bridge Engineer

Date: May 31, 2012

File: 08-Riv-215
PM 43.24
EA 08-334841
SE Connector
(SB215/EB215)

From: MICHAEL POPE
PE License No. C54503
Branch Chief, Design Branch 18 – MS9-DES.18
Division of Engineering Services
Office of Structure Design – South 1

Subject: Southeast Connector - Potential Pile Shaft Anomaly at Bent 15 – Structural Assessment

The Southeast Connector, part of the 215/91/60 Interchange in Riverside, is a 17 span cast-in-place, post-tensioned concrete connector ramp constructed in 2004 (see attachment). This structure has been recently investigated for the potential of erroneous gamma-gamma test data, and it was found that one of the inspection tubes in the pile shaft at Bent 15 is in question. Each of these large diameter shafts contains 14 PVC inspection tubes around its perimeter, providing voids in the concrete that enables test equipment to record data for the entire length of the shaft. When performing the structural assessment, the most conservative approach is to assume that a pie-shape section, proportional to the number of tubes in the shaft, contains no concrete. However, this assumption is not very realistic since most anomalies occur at construction joints, and close to the rebar cage.

Assuming erroneous data, and therefore no axial or flexural capacity in a pie-shaped section adjacent to the tube, the worst case scenario is that the pile shaft could have a reduction in capacity of about 7% (representing 1 tube out of 14). The gamma-gamma test results for the other 13 tubes showed no anomalies present, and the pile was accepted by Caltrans Office of Structure Construction. The main concern here is whether a potential 7% reduction in pile shaft capacity poses a safety concern to the traveling public.

It is my opinion that even with a 7% reduction in pile shaft capacity, the Bent 15 support, and therefore the Connector is safe for all loading conditions. The main reason for my

BARTON NEWTON

5/31/2012

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assessment relates to the philosophy used in the design of this "Type II" shaft. Caltrans Seismic Design Criteria (SDC) states "Type II shafts are designed so the plastic hinge will form at or above the shaft/column interface, thereby containing the majority of the inelastic action to the ductile column element. Type II shafts are usually enlarged shafts characterized by a reinforcing cage in the shaft that has a core diameter larger than that of the column it supports. Type II shafts shall be designed to remain elastic."

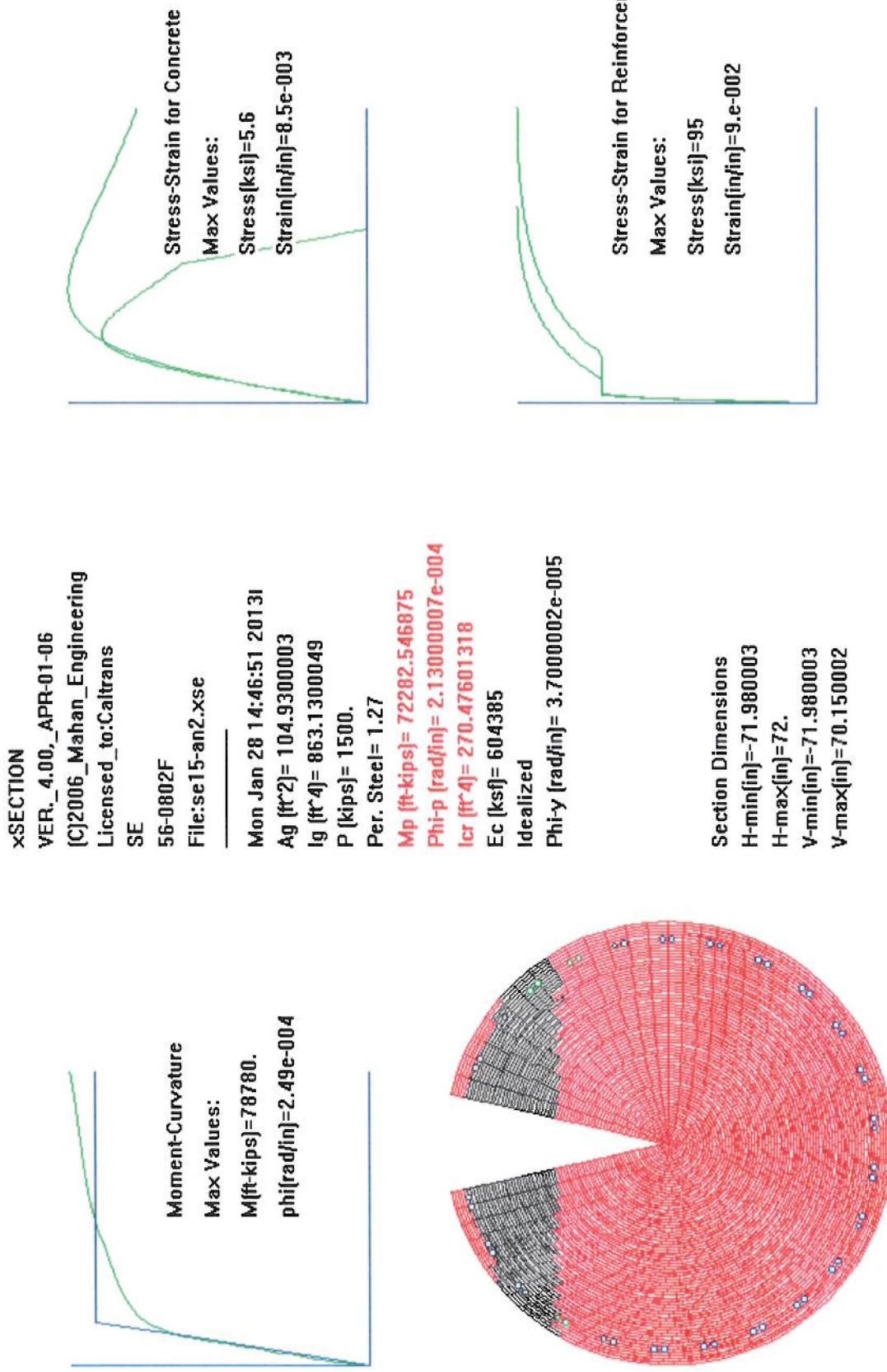
The Type II shafts on this project were designed to be "capacity protected" by the forces generated by the columns. The expected nominal moment capacity at any length along these shafts were designed to be at least 1.25 times the moment demand generated by the overstrength moment applied at the base of the column. Since the overstrength moment is based on the maximum moment that the column can produce, the pile shaft should not only be considered safe with a 7% reduction in capacity, but should also remain elastic under all loading conditions.

Attachments

c: Tony Marquez
Elias Kurani

/MP

XSection results for discounted compression steel and concrete wedge



C1DH STEEL ONLY
W/D ANALYSIS

se15-ab1.out

```
*****
*          XSECTION
*
*          DUCTILITY and STRENGTH of
*          Beams, Columns, Piles, Shafts, Footings, and
*          Various Structural Sections
*          using Fiber Models
*
* VER._4.00,_APR-01-06
*
* Copyright (C) 1994, 2006 By Mahan Engineering.
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* An appropriate license must be obtained for use of this
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*****
```

This output was generated by running:

```
XSECTION
VER._4.00,_APR-01-06
LICENSE (choices: LIMITED/UNLIMITED)
UNLIMITED
ENTITY (choices: GOVERNMENT/CONSULTANT)
Government
NAME_OF_FIRM
Caltrans
BRIDGE_NAME
SE
BRIDGE_NUMBER
56-0802F
JOB_TITLE
SE Connector, Bent 15
```

Concrete Type Information:

Type	e0	e2	ecc	eu	f0	f2	fcc	fu	E	w
1	0.0020	0.0040	0.0033	0.0085	5.00	5.56	5.64	4.32	4197	148
2	0.0020	0.0040	0.0020	0.0050	5.00	3.52	5.00	2.50	4197	148

Steel Type Information:

Type	ey	eh	eu	fu	E	
1	0.0023	0.0150	0.0900	68.00	95.00	29000
2	0.0023	0.0075	0.0600	68.00	95.00	29000

Steel Fiber Information:

Fiber No.	type	xc in	yc in	area in^2
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se15-ab1.out

1	2	66.73	-1.63	4.00
2	2	65.31	13.80	4.00
3	2	60.36	28.49	4.00
4	2	52.17	41.64	4.00
5	2	41.16	52.55	4.00
6	2	27.93	60.63	4.00
7	2	13.19	65.43	4.00
8	2	-2.25	66.71	4.00
9	2	-17.58	64.39	4.00
10	2	-31.95	58.60	4.00
11	2	-44.61	49.66	4.00
12	2	-54.86	38.03	4.00
13	2	-62.15	24.35	4.00
14	2	-66.09	9.36	4.00
15	2	-66.47	-6.13	4.00
16	2	-63.26	-21.29	4.00
17	2	-56.65	-35.31	4.00
18	2	-46.98	-47.42	4.00
19	2	-34.77	-56.98	4.00
20	2	-20.70	-63.46	4.00
21	2	-5.50	-66.52	4.00
22	2	9.98	-66.00	4.00
23	2	24.94	-61.92	4.00
24	2	38.54	-54.50	4.00
25	2	50.07	-44.14	4.00
26	2	58.90	-31.40	4.00
27	2	64.56	-16.97	4.00
28	2	66.73	1.63	4.00
29	2	64.56	16.98	4.00
30	2	58.90	31.41	4.00
31	2	50.07	44.14	4.00
32	2	38.54	54.50	4.00
33	2	24.93	61.92	4.00
34	2	9.98	66.00	4.00
35	2	-5.51	66.52	4.00
36	2	-20.70	63.46	4.00
37	2	-34.78	56.97	4.00
38	2	-46.98	47.42	4.00
39	2	-56.65	35.30	4.00
40	2	-63.26	21.29	4.00
41	2	-66.47	6.13	4.00
42	2	-66.09	-9.37	4.00
43	2	-62.15	-24.36	4.00
44	2	-54.85	-38.03	4.00
45	2	-44.60	-49.66	4.00
46	2	-31.95	-58.61	4.00
47	2	-17.57	-64.40	4.00
48	2	-2.25	-66.71	4.00
49	2	13.20	-65.43	4.00
50	2	27.93	-60.63	4.00
51	2	41.16	-52.55	4.00
52	2	52.17	-41.64	4.00
53	2	60.37	-28.49	4.00
54	2	65.31	-13.80	4.00

Force Equilibrium Condition of the x-section:

step	Max. Conc. Strain epscmax	Max. Neutral Axis in.	Steel Strain Tens. 0.00000	Steel Conc. Comp. 0	Steel force Comp. Tens. 0 0	P/S force 0	Net Curvature force rad/in 0.00	Moment (k-ft) 0.000000
0	0.00000	0.00	0.00000	0	0 0	0	0.00	0.000000

												se15-ab1.out
1	0.00017	15.04	-0.0002	1780	267	-548	0	-0.90	0.000003	10639		
2	0.00019	17.11	-0.0003	1868	287	-654	0	1.07	0.000003	11631		
3	0.00021	18.99	-0.0003	1966	310	-776	0	-0.27	0.000004	12730		
4	0.00023	20.63	-0.0004	2077	335	-913	0	-1.12	0.000004	13949		
5	0.00025	22.09	-0.0005	2203	363	-1066	0	-0.47	0.000005	15305		
6	0.00028	23.37	-0.0005	2345	393	-1238	0	0.36	0.000006	16807		
7	0.00031	24.52	-0.0006	2503	427	-1431	0	-0.82	0.000007	18469		
8	0.00034	25.51	-0.0007	2681	465	-1645	0	1.42	0.000007	20313		
9	0.00038	26.41	-0.0008	2878	507	-1884	0	1.31	0.000008	22352		
10	0.00042	27.22	-0.0009	3095	553	-2149	0	-1.43	0.000009	24603		
11	0.00046	27.91	-0.0010	3338	604	-2442	0	0.10	0.000011	27091		
12	0.00051	28.52	-0.0011	3605	661	-2766	0	-0.04	0.000012	29834		
13	0.00057	29.05	-0.0013	3900	724	-3125	0	-0.43	0.000013	32855		
14	0.00063	29.51	-0.0014	4226	794	-3519	0	0.94	0.000015	36179		
15	0.00069	29.92	-0.0016	4584	872	-3955	0	0.65	0.000016	39831		
16	0.00077	30.26	-0.0018	4975	958	-4434	0	-0.75	0.000018	43836		
17	0.00085	30.54	-0.0020	5405	1054	-4958	0	0.82	0.000020	48220		
18	0.00094	30.77	-0.0022	5871	1160	-5532	0	-1.39	0.000023	53004		
19	0.00103	31.05	-0.0025	6352	1275	-6127	0	0.13	0.000025	57871		
20	0.00114	31.82	-0.0028	6743	1390	-6633	0	-0.36	0.000028	61570		
21	0.00126	32.82	-0.0032	7075	1508	-7083	0	0.08	0.000032	64579		
22	0.00140	33.94	-0.0037	7362	1631	-7492	0	0.49	0.000037	67118		
23	0.00154	35.14	-0.0043	7606	1757	-7863	0	-0.41	0.000042	69259		
24	0.00171	36.35	-0.0049	7806	1893	-8200	0	-0.78	0.000048	71070		
25	0.00189	37.54	-0.0057	7972	2036	-8507	0	0.82	0.000055	72626		
26	0.00209	38.69	-0.0066	8102	2191	-8792	0	1.29	0.000063	73963		
27	0.00231	39.81	-0.0076	8189	2358	-9048	0	-0.75	0.000072	75095		
28	0.00255	40.73	-0.0088	8287	2544	-9331	0	0.52	0.000082	76667		
29	0.00282	41.53	-0.0100	8380	2754	-9634	0	-0.03	0.000093	78490		
30	0.00312	42.12	-0.0114	8506	2917	-9922	0	0.53	0.000104	80214		
31	0.00345	42.52	-0.0128	8663	3038	-10201	0	-0.15	0.000117	81840		
32	0.00381	42.82	-0.0143	8822	3147	-10469	0	-0.20	0.000131	83412		
33	0.00421	42.99	-0.0159	8983	3235	-10718	0	-0.46	0.000145	84869		
34	0.00466	42.96	-0.0176	9120	3331	-10952	0	-0.50	0.000160	86052		
35	0.00515	42.71	-0.0192	9203	3428	-11130	0	0.83	0.000176	86805		
36	0.00569	42.42	-0.0210	9277	3530	-11306	0	0.81	0.000192	87528		
37	0.00629	42.19	-0.0230	9394	3604	-11498	0	-0.23	0.000211	88451		
38	0.00695	41.99	-0.0252	9514	3674	-11687	0	0.86	0.000232	89447		
39	0.00769	41.78	-0.0276	9634	3733	-11867	0	0.15	0.000254	90412		
40	0.00850	41.57	-0.0302	9745	3802	-12046	0	0.20	0.000279	91352		

First Yield of Rebar Information (not Idealized):

Rebar Number 48

Coordinates X and Y (global in.) -2.25, -66.71

Yield strain = 0.00230

Curvature (rad/in)= 0.000024

Moment (ft-k) = 54879

Cross Section Information:

Axial Load on Section (kips) = 1500

Percentage of Main steel in Cross Section = 1.33

Concrete modulus used in Idealization (ksi) = 4197

Cracked Moment of Inertia (ft^4) = 320.901

Idealization of Moment-Curvature Curve by Various Methods:

Points on Curve	Idealized values
	Page 3

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Method ID	Conc. in/in	=====			Yield Curv. rad/in	Moment (k-ft)	for moment rad/in	Plastic Curv. rad/in
		Strain	Curv. rad/in	Moment (k-ft)				
Strain @ 0.003	0.000100	79534	0.000034	79534	Mn	0.000245		
Strain @ 0.004	0.000137	84101	0.000036	84101	Mn	0.000243		
Strain @ 0.005	0.000171	86579	0.000037	86579	Mn	0.000242		
CALTRANS	0.00382	83433	0.000036	83433	Mp	0.000243		
UCSD@5phy	0.00347	81953	0.000035	81953	Mn	0.000244		

se15-an1.out

CIDR STEEL ONLY
W15x11 AVERAGE

```
*****
*          XSECTION
*
*          DUCTILITY and STRENGTH of
*          Beams, Columns, Piles, Shafts, Footings, and
*          Various Structural Sections
*          using Fiber Models
*
* VER._4.00,_APR-01-06
*
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```

This output was generated by running:

```
XSECTION
VER._4.00,_APR-01-06
LICENSE (choices: LIMITED/UNLIMITED)
UNLIMITED
ENTITY (choices: GOVERNMENT/CONSULTANT)
Government
NAME_OF_FIRM
Caltrans
BRIDGE_NAME
SE
BRIDGE_NUMBER
56-0802F
JOB_TITLE
SE Connector, Bent 15
```

73556 K.FT
79534 K.FT
7.7 % DECREASE
IN MOMENT CAPACITY

Concrete Type Information:

Type	e0	e2	ecc	eu	f0	f2	fcc	fu	E	w
1	0.0020	0.0040	0.0033	0.0085	5.00	5.56	5.64	4.32	4197	148
2	0.0020	0.0040	0.0020	0.0050	5.00	3.52	5.00	2.50	4197	148

Steel Type Information:

Type	ey	eh	eu	fu	E	
1	0.0023	0.0150	0.0900	68.00	95.00	29000
2	0.0023	0.0075	0.0600	68.00	95.00	29000

Steel Fiber Information:

Fiber No.	type	xc in	yc in	area in^2
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1	2	66.73	-1.63	4.00
2	2	65.31	13.80	4.00
3	2	60.36	28.49	4.00
4	2	52.17	41.64	4.00
5	2	41.16	52.55	4.00
6	2	27.93	60.63	4.00
7	2	13.19	65.43	4.00
8	2	-2.25	66.71	4.00
9	2	-17.58	64.39	4.00
10	2	-31.95	58.60	4.00
11	2	-44.61	49.66	4.00
12	2	-54.86	38.03	4.00
13	2	-62.15	24.35	4.00
14	2	-66.09	9.36	4.00
15	2	-66.47	-6.13	4.00
16	2	-63.26	-21.29	4.00
17	2	-56.65	-35.31	4.00
18	2	-46.98	-47.42	4.00
19	2	-34.77	-56.98	4.00
20	2	-20.70	-63.46	4.00
21	2	-5.50	-66.52	4.00
22	2	9.98	-66.00	4.00
23	2	24.94	-61.92	4.00
24	2	38.54	-54.50	4.00
25	2	50.07	-44.14	4.00
26	2	58.90	-31.40	4.00
27	2	64.56	-16.97	4.00
28	2	66.73	1.63	4.00
29	2	64.56	16.98	4.00
30	2	58.90	31.41	4.00
31	2	50.07	44.14	4.00
32	2	38.54	54.50	4.00
33	2	24.93	61.92	4.00
34	2	9.98	66.00	4.00
35	2	-5.51	66.52	4.00
36	2	-20.70	63.46	4.00
37	2	-34.78	56.97	4.00
38	2	-46.98	47.42	4.00
39	2	-56.65	35.30	4.00
40	2	-63.26	21.29	4.00
41	2	-66.47	6.13	4.00
42	2	-66.09	-9.37	4.00
43	2	-62.15	-24.36	4.00
44	2	-54.85	-38.03	4.00
45	2	-44.60	-49.66	4.00
46	2	-31.95	-58.61	4.00
47	2	-17.57	-64.40	4.00
48	2	-2.25	-66.71	4.00
49	2	13.20	-65.43	4.00
50	2	27.93	-60.63	4.00
51	2	41.16	-52.55	4.00
52	2	52.17	-41.64	4.00
53	2	60.37	-28.49	4.00
54	2	65.31	-13.80	4.00

Force Equilibrium Condition of the x-section:

Max.	Max.	Max.	Steel	Steel	P/S	Net	Curvature	Moment
Conc.	Neutral	Axis	Strain	Conc.	force	force	force	(K-ft)
step	Strain	Axis	Strain	Comp.	Comp.	Tens.	P/S	rad/in
0	epscmax	in.	Tens.	Comp.	Comp.	Tens.	force	0.00
0	0.00000	0.00	0.00000	0	0	0	0	0.000000

								sel15-an1.out			
1	0.00017	7.75	-0.0002	1631	299	-431	0	-0.73	0.000003	8931	
2	0.00019	10.08	-0.0002	1698	322	-520	0	0.85	0.000003	9777	
3	0.00021	12.19	-0.0003	1775	348	-622	0	1.14	0.000004	10714	
4	0.00023	14.06	-0.0003	1861	377	-737	0	0.50	0.000004	11750	
5	0.00025	15.75	-0.0004	1959	408	-869	0	-1.29	0.000005	12900	
6	0.00028	17.22	-0.0004	2072	443	-1015	0	-0.27	0.000005	14176	
7	0.00031	18.54	-0.0005	2198	482	-1181	0	-0.72	0.000006	15590	
8	0.00034	19.71	-0.0006	2339	525	-1365	0	-0.81	0.000007	17156	
9	0.00038	20.74	-0.0007	2497	573	-1570	0	-0.16	0.000008	18890	
10	0.00042	21.66	-0.0008	2674	625	-1798	0	0.31	0.000009	20808	
11	0.00046	22.48	-0.0009	2868	684	-2053	0	-1.12	0.000010	22927	
12	0.00051	23.19	-0.0010	3086	748	-2333	0	1.11	0.000011	25266	
13	0.00057	23.83	-0.0011	3326	819	-2645	0	-0.10	0.000012	27846	
14	0.00063	24.39	-0.0012	3591	898	-2989	0	0.28	0.000014	30688	
15	0.00069	24.88	-0.0014	3882	987	-3370	0	-0.92	0.000015	33814	
16	0.00077	25.29	-0.0016	4203	1085	-3787	0	0.71	0.000017	37247	
17	0.00085	25.64	-0.0018	4554	1193	-4246	0	0.62	0.000019	41011	
18	0.00094	25.94	-0.0020	4937	1313	-4751	0	-0.90	0.000021	45129	
19	0.00103	26.17	-0.0022	5355	1447	-5301	0	1.30	0.000024	49626	
20	0.00114	26.43	-0.0024	5792	1593	-5886	0	-1.29	0.000026	54328	
21	0.00126	27.16	-0.0028	6139	1741	-6380	0	-0.09	0.000029	57941	
22	0.00140	28.14	-0.0032	6427	1894	-6820	0	1.29	0.000033	60924	
23	0.00154	29.28	-0.0036	6659	2056	-7216	0	-0.32	0.000038	63402	
24	0.00171	30.48	-0.0042	6851	2228	-7578	0	1.14	0.000043	65550	
25	0.00189	31.72	-0.0048	6998	2410	-7907	0	0.03	0.000049	67382	
26	0.00209	32.96	-0.0056	7104	2608	-8211	0	0.10	0.000056	68976	
27	0.00231	34.18	-0.0065	7167	2817	-8485	0	-0.92	0.000064	70356	
28	0.00255	35.37	-0.0075	7191	3039	-8732	0	-1.35	0.000073	71566	
29	0.00282	36.27	-0.0086	7264	3235	-8998	0	1.34	0.000083	72988	
30	0.00312	36.93	-0.0097	7384	3372	-9257	0	-0.76	0.000094	74421	
31	0.00345	37.38	-0.0109	7531	3482	-9513	0	-0.11	0.000105	75860	
32	0.00381	37.73	-0.0123	7681	3580	-9761	0	-0.18	0.000118	77275	
33	0.00421	37.97	-0.0137	7836	3664	-9999	0	0.02	0.000131	78637	
34	0.00466	38.05	-0.0152	7976	3752	-10228	0	-0.59	0.000145	79853	
35	0.00515	37.95	-0.0167	8086	3841	-10426	0	1.41	0.000160	80791	
36	0.00569	37.72	-0.0183	8195	3921	-10614	0	1.12	0.000175	81580	
37	0.00629	37.56	-0.0201	8292	4006	-10798	0	-0.33	0.000193	82482	
38	0.00695	37.37	-0.0221	8412	4071	-10985	0	-1.08	0.000212	83420	
39	0.00769	37.17	-0.0242	8532	4141	-11174	0	-0.87	0.000233	84378	
40	0.00850	36.92	-0.0265	8657	4197	-11355	0	-0.41	0.000256	85275	

First Yield of Rebar Information (not Idealized):

Rebar Number 48

Coordinates X and Y (global in.) -2.25, -66.71

Yield strain = 0.00230

Curvature (rad/in)= 0.000025

Moment (ft-k) = 51948

Cross Section Information:

Axial Load on Section (kips) = 1500

Percentage of Main steel in Cross Section = 1.43

Concrete modulus used in Idealization (ksi) = 4197

Cracked Moment of Inertia (ft^4) = 289.551

Idealization of Moment-Curvature Curve by Various Methods:

Points on Curve	Idealized Values
	Page 3

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Method ID	Conc. in/in	=====			Yield Curv. rad/in	Moment (K-ft)	Yield Curv. rad/in	Moment (K-ft)	symbol for moment	Plastic Curv. rad/in
		Strain in/in	Curv. rad/in	Moment (K-ft)						
Strain @ 0.003	0.000090		73856	0.000035	73856	Mn	0.000221			
Strain @ 0.004	0.000124		77919	0.000037	77919	Mn	0.000219			
Strain @ 0.005	0.000155		80509	0.000038	80509	Mn	0.000217			
CALTRANS	0.00403	0.000125	78036	0.000037	78036	Mp	0.000219			
UCSD@5phy	0.00400	0.000124	77905	0.000037	77905	Mn	0.000219			

NO AS BUILT CORRECTIONS

NOTES:

- For Sections G-G and H-H see "Bent Details No. 4" sheet
- For Sections I-I and J-J see "Bent Details No. 5" sheet
- Column isolation isolating for Section 4, 9, 10, 11, 12, 13 & 17 is not shown see "Column Isolation Detail" sheet
- For pile date, see "Index To Plans" sheet
- All hoops are "Ultimate" butt splice Continuous
- Only staggered "Ultimate" butt splices are allowed in main column reinforcement
- Only staggered "Ultimate" butt splices are allowed in main CIPH pile reinforcement
- see "Deck Drainage connection" for deck drainage connection
- (Bents 4, 5, 6, 9, and 12-16) (Bent 17 has 2 Deck Drain Piles & 2 ex 13 @ Base of Column)
- Denotes horizontally bundled hoops
- Denotes vertically bundled main in CIPH pile reinforcement
- Column
- BENT 10

SECTION F-F

ELEVATION BENTS 4 - 17

DESIGN SEQUENCE 1

SE CONNECTOR (SB215 / EB215)

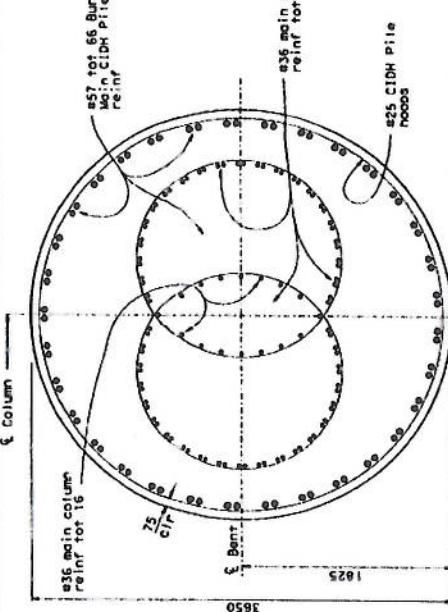
BENTS DETAILS NO. 3

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

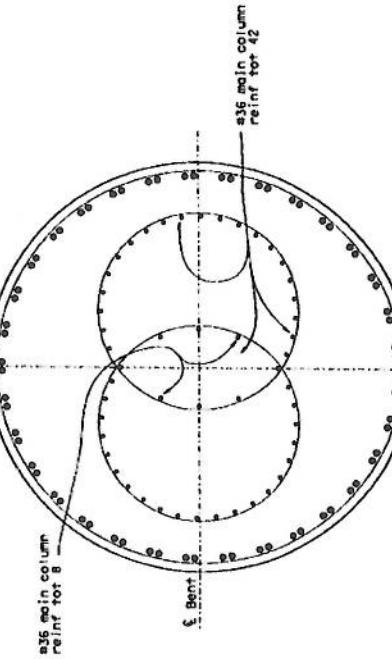
SESSION	STRUCTURE	STATE OF CALIFORNIA	DIVISION OF STRUCTURES	STRUCTURE DESIGN	EDITION NO.
SECTION	F-F	C. Incidental C. Abnormal C. Uniform C. Uniform C. Uniform	DEPARTMENT OF TRANSPORTATION	17	5e-08/25-169-56
DETAILS	4-17				
QUANTITY	1				
UNIT	Each				
HALF IN MILLIMETERS	0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310 320 330 340 350 360 370 380 390 400 410 420 430 440 450 460 470 480 490 500 510 520 530 540 550 560 570 580 590 600 610 620 630 640 650 660 670 680 690 700 710 720 730 740 750 760 770 780 790 800 810 820 830 840 850 860 870 880 890 900 910 920 930 940 950 960 970 980 990 1000 1010 1020 1030 1040 1050 1060 1070 1080 1090 1100 1110 1120 1130 1140 1150 1160 1170 1180 1190 1200 1210 1220 1230 1240 1250 1260 1270 1280 1290 1300 1310 1320 1330 1340 1350 1360 1370 1380 1390 1400 1410 1420 1430 1440 1450 1460 1470 1480 1490 1500 1510 1520 1530 1540 1550 1560 1570 1580 1590 1600 1610 1620 1630 1640 1650 1660 1670 1680 1690 1700 1710 1720 1730 1740 1750 1760 1770 1780 1790 1800 1810 1820 1830 1840 1850 1860 1870 1880 1890 1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010 2020 2030 2040 2050 2060 2070 2080 2090 2100 2110 2120 2130 2140 2150 2160 2170 2180 2190 2200 2210 2220 2230 2240 2250 2260 2270 2280 2290 2200 2300 2310 2320 2330 2340 2350 2360 2370 2380 2390 2300 2400 2410 2420 2430 2440 2450 2460 2470 2480 2490 2400 2500 2510 2520 2530 2540 2550 2560 2570 2580 2590 2500 2600 2610 2620 2630 2640 2650 2660 2670 2680 2690 2600 2700 2710 2720 2730 2740 2750 2760 2770 2780 2790 2700 2800 2810 2820 2830 2840 2850 2860 2870 2880 2890 2800 2900 2910 2920 2930 2940 2950 2960 2970 2980 2990 2900 3000 3010 3020 3030 3040 3050 3060 3070 3080 3090 3000 3100 3110 3120 3130 3140 3150 3160 3170 3180 3190 3100 3200 3210 3220 3230 3240 3250 3260 3270 3280 3290 3200 3300 3310 3320 3330 3340 3350 3360 3370 3380 3390 3300 3400 3410 3420 3430 3440 3450 3460 3470 3480 3490 3400 3500 3510 3520 3530 3540 3550 3560 3570 3580 3590 3500 3600 3610 3620 3630 3640 3650 3660 3670 3680 3690 3600 3700 3710 3720 3730 3740 3750 3760 3770 3780 3790 3700 3800 3810 3820 3830 3840 3850 3860 3870 3880 3890 3800 3900 3910 3920 3930 3940 3950 3960 3970 3980 3990 3900 4000 4010 4020 4030 4040 4050 4060 4070 4080 4090 4000 4100 4110 4120 4130 4140 4150 4160 4170 4180 4190 4100 4200 4210 4220 4230 4240 4250 4260 4270 4280 4290 4200 4300 4310 4320 4330 4340 4350 4360 4370 4380 4390 4300 4400 4410 4420 4430 4440 4450 4460 4470 4480 4490 4400 4500 4510 4520 4530 4540 4550 4560 4570 4580 4590 4500 4600 4610 4620 4630 4640 4650 4660 4670 4680 4690 4600 4700 4710 4720 4730 4740 4750 4760 4770 4780 4790 4700 4800 4810 4820 4830 4840 4850 4860 4870 4880 4890 4800 4900 4910 4920 4930 4940 4950 4960 4970 4980 4990 4900 5000 5010 5020 5030 5040 5050 5060 5070 5080 5090 5000 5100 5110 5120 5130 5140 5150 5160 5170 5180 5190 5100 5200 5210 5220 5230 5240 5250 5260 5270 5280 5290 5200 5300 5310 5320 5330 5340 5350 5360 5370 5380 5390 5300 5400 5410 5420 5430 5440 5450 5460 5470 5480 5490 5400 5500 5510 5520 5530 5540 5550 5560 5570 5580 5590 5500 5600 5610 5620 5630 5640 5650 5660 5670 5680 5690 5600 5700 5710 5720 5730 5740 5750 5760 5770 5780 5790 5700 5800 5810 5820 5830 5840 5850 5860 5870 5880 5890 5800 5900 5910 5920 5930 5940 5950 5960 5970 5980 5990 5900 6000 6010 6020 6030 6040 6050 6060 6070 6080 6090 6000 6100 6110 6120 6130 6140 6150 6160 6170 6180 6190 6100 6200 6210 6220 6230 6240 6250 6260 6270 6280 6290 6200 6300 6310 6320 6330 6340 6350 6360 6370 6380 6390 6300 6400 6410 6420 6430 6440 6450 6460 6470 6480 6490 6400 6500 6510 6520 6530 6540 6550 6560 6570 6580 6590 6500 6600 6610 6620 6630 6640 6650 6660 6670 6680 6690 6600 6700 6710 6720 6730 6740 6750 6760 6770 6780 6790 6700 6800 6810 6820 6830 6840 6850 6860 6870 6880 6890 6800 6900 6910 6920 6930 6940 6950 6960 6970 6980 6990 6900 7000 7010 7020 7030 7040 7050 7060 7070 7080 7090 7000 7100 7110 7120 7130 7140 7150 7160 7170 7180 7190 7100 7200 7210 7220 7230 7240 7250 7260 7270 7280 7290 7200 7300 7310 7320 7330 7340 7350 7360 7370 7380 7390 7300 7400 7410 7420 7430 7440 7450 7460 7470 7480 7490 7400 7500 7510 7520 7530 7540 7550 7560 7570 7580 7590 7500 7600 7610 7620 7630 7640 7650 7660 7670 7680 7690 7600 7700 7710 7720 7730 7740 7750 7760 7770 7780 7790 7700 7800 7810 7820 7830 7840 7850 7860 7870 7880 7890 7800 7900 7910 7920 7930 7940 7950 7960 7970 7980 7990 7900 8000 8010 8020 8030 8040 8050 8060 8070 8080 8090 8000 8100 8110 8120 8130 8140 8150 8160 8170 8180 8190 8100 8200 8210 8220 8230 8240 8250 8260 8270 8280 8290 8200 8300 8310 8320 8330 8340 8350 8360 8370 8380 8390 8300 8400 8410 8420 8430 8440 8450 8460 8470 8480 8490 8400 8500 8510 8520 8530 8540 8550 8560 8570 8580 8590 8500 8600 8610 8620 8630 8640 8650 8660 8670 8680 8690 8600 8700 8710 8720 8730 8740 8750 8760 8770 8780 8790 8700 8800 8810 8820 8830 8840 8850 8860 8870 8880 8890 8800 8900 8910 8920 8930 8940 8950 8960 8970 8980 8990 8900 9000 9010 9020 9030 9040 9050 9060 9070 9080 9090 9000 9100 9110 9120 9130 9140 9150 9160 9170 9180 9190 9100 9200 9210 9220 9230 9240 9250 9260 9270 9280 9290 9200 9300 9310 9320 9330 9340 9350 9360 9370 9380 9390 9300 9400 9410 9420 9430 9440 9450 9460 9470 9480 9490 9400 9500 9510 9520 9530 9540 9550 9560 9570 9580 9590 9500 9600 9610 9620 9630 9640 9650 9660 9670 9680 9690 9600 9700 9710 9720 9730 9740 9750 9760 9770 9780 9790 9700 9800 9810 9820 9830 9840 9850 9860 9870 9880 9890 9800 9900 9910 9920 9930 9940 9950 9960 9970 9980 9990 9900 10000 10010 10020 10030 10040 10050 10060 10070 10080 10090 10000 10100 10110 10120 10130 10140 10150 10160 10170 10180 10190 10100 10200 10210 10220 10230 10240 10250 10260 10270 10280 10290 10200 10300 10310 10320 10330 10340 10350 10360 10370 10380 10390 10300 10400 10410 10420 10430 10440 10450 10460 10470 10480 10490 10400 10500 10510 10520 10530 10540 10550 10560 10570 10580 10590 10500 10600 10610 10620 10630 10640 10650 10660 10670 10680 10690 10600 10700 10710 10720 10730 10740 10750 10760 10770 10780 10790 10700 10800 10810 10820 10830 10840 10850 10860 10870 10880 10890 10800 10900 10910 10920 10930 10940 10950 10960 10970 10980 10990 10900 11000 11010 11020 11030 11040 11050 11060 11070 11080 11090 11000 11100 11110 11120 11130 11140 11150 11160 11170 11180 11190 11100 11200 11210 11220 11230 11240 11250 11260 11270 11280 11290 11200 11300 11310 11320 11330 11340 11350 11360 11370 11380 11390 11300 11400 11410 11420 11430 11440 11450 11460 11470 11480 11490 11400 11500 11510 11520 11530 11540 11550 11560 11570 11580 11590 11500 11600 11610 11620 11630 11640 11650 11660 11670 11680 11690 11600 11700 11710 11720 11730 11740 11750 11760 11770 11780 11790 11700 11800 11810 11820 11830 11840 11850 11860 11870 11880 11890 11800 11900 11910 11920 11930 11940 11950 11960 11970 11980 11990 11900 12000 12010 12020 12030 12040 12050 12060 12070 12080 12090 12000 12100 12110 12120 12130 12140 12150 12160 12170 12180 12190 12100 12200 12210 12220 12230 12240 12250 12260 12270 12280 12290 12200 12300 12310 12320 12330 12340 12350 12360 12370 12380 12390 12300 12400 12410 12420 12430 12440 12450 12460 12470 12480 12490 12400 12500 12510 12520 12530 12540 12550 12560 12570 12580 12590 12500 12600 12610 12620 12630 12640 12650 12660 12670 12680 12690 12600 12700 12710 12720 12730 12740 12750 12760 12770 12780 12790 12700 12800 12810 12820 12830 12840 12850 12860 12870 12880 12890 12800 12900 12910 12920 12930 12940 12950 12960 12970 12980 12990 12900 13000 13010 13020 13030 13040 13050 13060 13070 13080 13090 13000 13100 13110 13120 13130 13140 13150 13160 13170 13180 13190 13100 13200 13210 13220 13230 13240 13250 13260 13270 13280 13290 13200 13300 13310 13320 13330 13340 13350 13360 13370 13380 13390 13300 13400 13410 13420 13430 13440 13450 13460 13470 13480 13490 13400 13500 13510 13520 13530 13540 13550 13560 13570 13580 13590 13500 13600 13610 13620 13630 13640 13650 13660 13670 13680 13690 13600 13700 13710 13720 13730 13740 13750 13760 13770 13780 13790 13700 13800 13810 13820 13830 13840 13850 13860 13870 13880 13890 13800 13900 13910 13920 13930 13940 13950 13960 13970 13980 13990 13900 14000 14010 14020 14030 14040 14050 14060 14070 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SEARCHED	INDEXED	SERIALIZED	FILED
SEARCHED	INDEXED	SERIALIZED	FILED
MAY 10 1968			
FBI - NEW YORK			

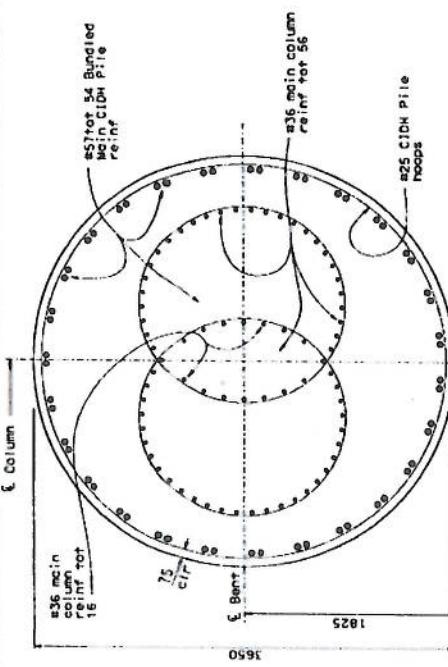
NOTES:
 For locations of Sections C-C and H-H see
 Bent Details No. J sheet.
 For Section F-F, Bents 4-10, 12, 13 & 15-17
 and Section G-G, Bents 11 & 14 see
 Bent Details No. J sheet.



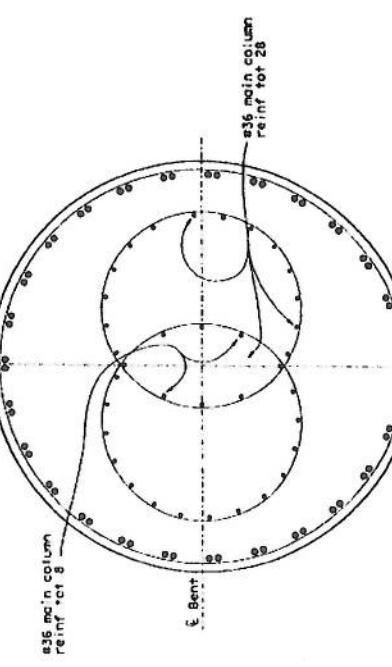
SECTION G-C



SECTION H-H



NOTE:
For Details and reinfo not shown see
Section F-F, Sheets 4-10, 12, 13, & 15-17
DETAILS 4-10 12 13 & 15-17



NOTE :
For Details and reinf no^t shown see
Section G-G, Bents 4-10, 12, 13, & 15-17

115	TONS	BUFT	SILO	PIER	STRUCTURE	DATE
139	41.1	11.61	49.75	27.08	2008/2/15	

REGISTERED CIVIL ENGINEER DATE
RICHARD L. ROBERTS
P.E. #123456
PARKS APPROVAL DATE
12/20/08

NOTICE: THIS SHEET IS GOVERNED BY THE TERMS AND CONDITIONS OF CONTRACT FOR CONSULTING SERVICES FOR ENGINEERING WORKS OF ENGINEERING AND ARCHITECTURAL NATURE, WHICH ARE CONTAINED IN THE AGREEMENT OF CONSULTANCY AND IN THE SPECIFICATIONS OF THE WORKS.

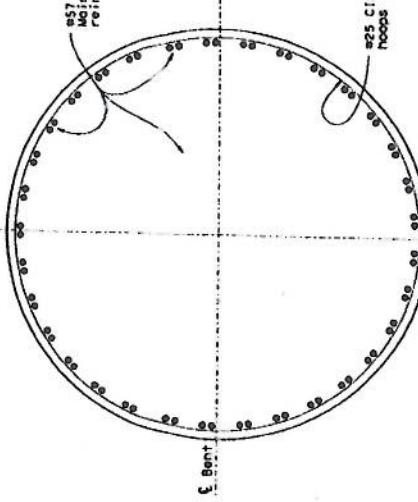
BENT DETAILS NO. 1 & 2 SEE SHEET NO. 1 & 2

NOTES:

- For locations of Sections I-I and J-J see "Bent Details No. 3" sheet.
- For Section G-G, Bents 4-10, 12, 13 & 15-17
Open Section G-G, Bents 11 & 14 see
Bent Details No. 2" sheet.



#57 tot 66 Bundled Main CIDH Pile Reinf



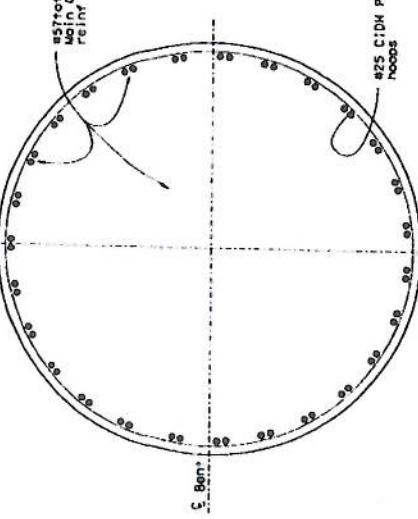
NOTE:
For Details not shown see
Section G-G, Bents 4-10, 12, 13 & 15-17
BENTS 4-10, 12, 13 & 15-17

SECTION I-I

1:20



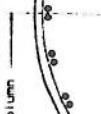
#57 tot 54 Bundled Main CIDH Pile Reinf



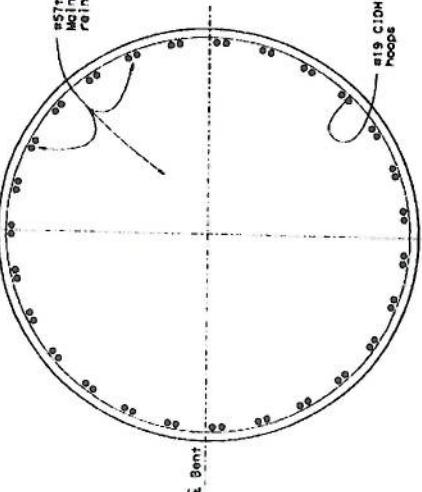
NOTE:
For Details not shown see
Section G-G, Bents 4-10, 12, 13 & 15-17
BENTS 4-10, 12, 13 & 15-17

SECTION J-J

1:20



#57 tot 66 Bundled Main CIDH Pile Reinf



NOTE:
For Details not shown see
Section G-G, Bents 4-10, 12, 13 & 15-17
BENTS 4-10, 12, 13 & 15-17

NO AS BUILT CORRECTIONS

DESIGN SEQUENCE 1

SECTION (SB215 / EB215)

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

NOTE: Details not shown see Section G-G, Bents 11 & 14

BENTS 11 & 14

NOTE: Details not shown see Section G-G, Bents 11 & 14

BENTS 11 & 14

STATE OF CALIFORNIA		DIVISION OF STRUCTURES		STRUCTURE DESIGN 17		DEPARTMENT OF TRANSPORTATION	
Design	C. Hatching	Struct.	U.S. Units	Struct.	U.S. Units	Struct.	U.S. Units
PC-Ants							
Quantity	C. Hatching						

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APPENDIX C

LAKE HODGES BRIDGE, BR. NO. 57-1134R (ID-11) BACKUP DOCUMENTATION

1. Designer's Structural Assessment Memo
2. 'X-section' program run output for Abutment pile with anomaly
3. Additional As-built plans

Memorandum

*Flex your power!
Be energy efficient!*

To: **BARTON NEWTON**
Deputy Division Chief
Structure Policy and Innovation
State Bridge Engineer

Date: January 23, 2013

File: EA 11-080924
11-SD-15, PM 26.2
Br. No. 57-1134R
Lake Hodges Bridge

From: **RICHARD SCHENDEL**
Senior Bridge Engineer
Office of Structure Design – South 1
Senior Project Engineer, Branch 18

Subject: Lake Hodges Bridge Structural Assessment with Potential Pile Shaft Anomaly at Pile 1 of Abutment 6 - Revised

It has come to my attention that data collected from gamma-gamma testing at the above location from one of the inspection tubes (Tube #2) may have been collected erroneously. I have been tasked as the structure design Engineer of Record to make an assessment of the structural adequacy of the bridge support system at the above location, conservatively assuming that the portion of the pile shaft represented by the aforementioned inspection tube is entirely anomalous. Based on information collected during the time of construction, Pile 1 is the most easterly pile shaft as shown in the attachment.

Assuming that the data collected from the aforementioned inspection tube is entirely anomalous, it is my professional judgment that the structural safety of the bridge has not been compromised. Additionally, the minimum required factors of safety to which the structure was designed would still be maintained. The above judgment is based on the following:

1. A review of the design details, design calculations, and the gamma-gamma test reports for all of the Abutment 6 pile shafts
2. Additional analysis to determine the reduced moment, shear, and axial capacity of the pile shaft with the assumed anomaly in place
3. A discussion with the engineers from Geotechnical Services who originally determined the pile shaft tip elevation required for vertical loading

The abutment system consists of a very stout retaining wall supported on a line of 18 large diameter pile shafts. This system is highly redundant and very efficient at sharing

BARTON NEWTON

January 23, 2013

Page 2

load from pile shaft to pile shaft. Design loads imparted to the abutment system are resisted by the pile shaft group in its entirety. The controlling lateral design loading to the piles consisted of lateral earth pressure, lateral spreading loads during the design seismic event, and lateral superstructure demand loads. The controlling vertical design loading to the piles consisted of dead and live load.

Analysis was done to determine the reduced moment capacity of one pile section assuming that the portion of the concrete pile represented by the assumed anomalous zone was one-quarter pie-shaped (a 25% reduction of concrete pile area and corresponding compression reinforcement). The results of this analysis showed that the pile moment capacity would be reduced to a minimum of 58% of its original design capacity. This would reduce the lateral capacity of the abutment 18-pile system to $(0.58*1+1.0*17)/18 = 97.7\%$ of its original design. Based on the original structural design calculations, the final structural lateral design capacity of the pile shafts exceeded the necessary lateral structural design demand by 18%. Therefore, it can be seen that the lateral design capacity of the abutment system would still exceed the lateral design demand.

With regard to pile shear demand from lateral loading, the original calculations show that the shear capacity of the pile shaft exceeded the shear demand by at least 45%. If one were to conservatively assume a 25% reduction in shear capacity due to the assumed anomalous concrete, the shear capacity would still exceed the shear demand.

Analysis was also done to ensure that the structural axial resistance of the pile shaft would still be adequate assuming that 25% of the concrete is anomalous. It was determined that the structural axial resistance would significantly exceed the demand.

Based on discussion with the engineers from Geotechnical Services who originally provided the pile shaft tip elevation required for axial resistance, it was determined that the skin friction capacity within the bottom one diameter of the pile shaft as well as the end bearing component of resistance were both conservatively neglected in the original calculations. The only capacity considered was the skin friction from the bottom of steel casing to within one diameter from the bottom of the pile shaft. Since the results of gamma-gamma testing for this particular pile shaft indicated no significant anomalies within the bottom one diameter of the shaft, additional skin friction within the bottom one diameter of the shaft as well as end bearing resistance (both represented by the three non-anomalous gamma-gamma tubes) could be used to determine the pile's geotechnical axial capacity. The amount of increased capacity would more than offset the assumed 25% reduction in capacity represented by the assumed anomalous tube.

BARTON NEWTON

January 23, 2013

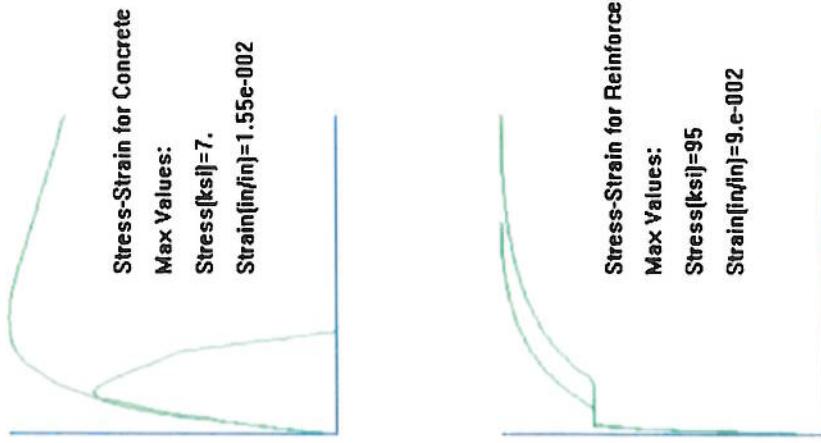
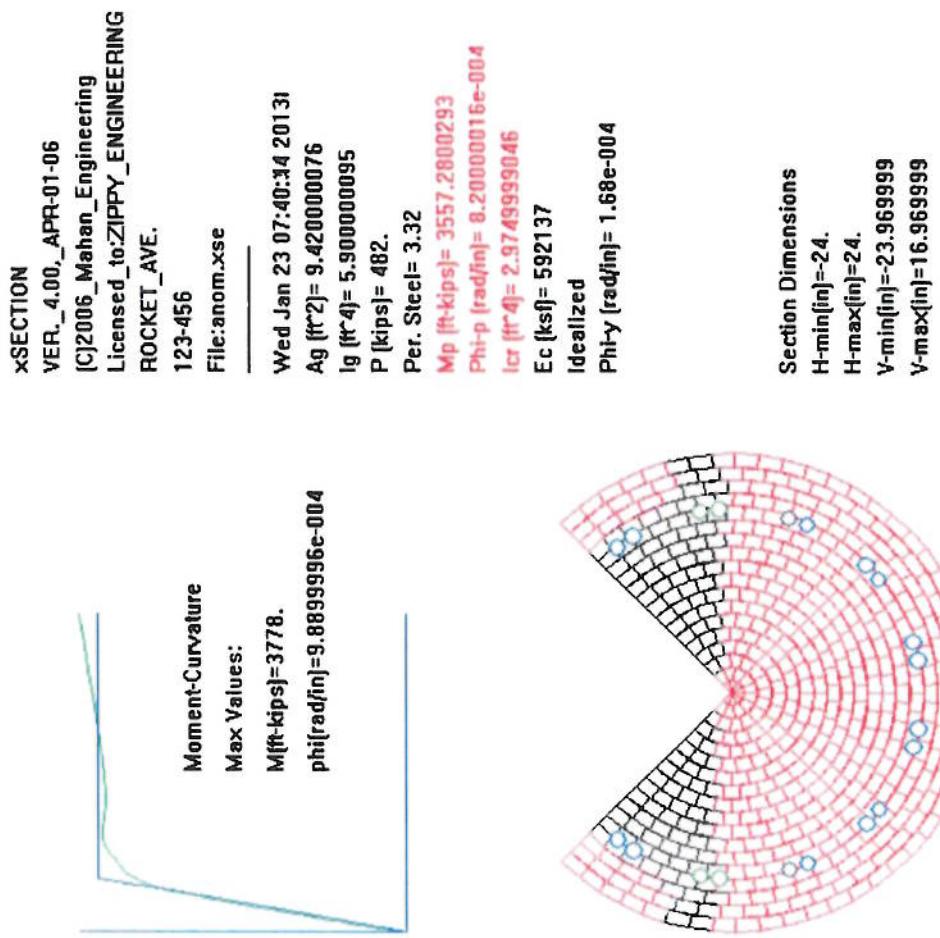
Page 3

Please contact me if any further structural assessment is necessary.

Richard Schendel, P.E.

License No. C 64259

Worst case scenario w/discounted wedge along compression side



Xsection results for discounted wedge oriented along tube no. 2

xSECTION
VER_4.00,_APR-01-06
(C)2006_Mahan_Engineering
Licensed_to:ZIPPY_ENGINEERING
ROCKET_AVE.
123-456
File:anom138.xse

Moment-Curvature

Max Values:

$$M(\text{ft-kips})=4267.$$

$$\phi(\text{rad})=1.1690001e-003$$

Wed Jan 23 07:44:32 20131

$$Ag(\text{ft}^2)=9.420000076$$

$$Ig(\text{ft}^4)=8.369999886$$

$$P(\text{kips})=482.$$

$$Per. Steel=3.32$$

$$Mp(\text{ft-kips})=4011.790003906$$

$$\Phi_i-p(\text{rad})=1.04400003e-003$$

$$Icr(\text{ft}^4)=4.5269999504$$

$$Ec(\text{ksf})=592137$$

Idealized

$$\Phi_i-y(\text{rad})=1.25000001e-004$$

Stress-Strain for Concrete

Max Values:

$$Stress(\text{ksi})=7.$$

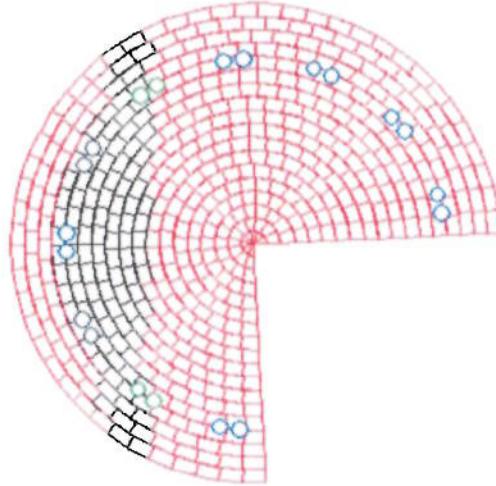
$$Strain(\text{in/in})=1.55e-002$$

Stress-Strain for Reinforcement

Max Values:

$$Stress(\text{ksi})=95$$

$$Strain(\text{in/in})=9.e-002$$



Section Dimensions

$$H-min(\text{in})=-23.969999$$

$$H-max(\text{in})=24.$$

$$Y-min(\text{in})=-23.969999$$

$$Y-max(\text{in})=24.$$

ANOM68%.OUT

01/23/2013, 07:43

```
*****
*          XSECTION
*
*      DUCTILITY and STRENGTH of
*      Circular, Semi-Circular, full and partial Rings,
*      Rectangular, T-, I-, Hammer head, Octagonal, Polygons
*      or any combination of above shapes forming
*      Concrete Sections using Fiber Models
*
* VER._2.40,_MAR-14-99
*
* Copyright (C) 1994, 1995, 1999 By Mark Seyed Mahan.
*
* A proper license must be obtained to use this software.
* For GOVERNMENT work call 916-227-8404, otherwise leave a
* message at 530-756-2367. The author makes no expressed or
* implied warranty of any kind with regard to this program.
* In no event shall the author be held liable for
* incidental or consequential damages arising out of the
* use of this program.
*****
```

This output was generated by running:

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xSECTION
VER._2.40,_MAR-14-99
LICENSE (choices: LIMITED/UNLIMITED)
LIMITED
ENTITY (choices: GOVERNMENT/CONSULTANT)
CONSULTANT
NAME_OF_FIRM
ZIPPY_ENGINEERING
BRIDGE_NAME
ROCKET_AVE.
BRIDGE_NUMBER
123-456
JOB_TITLE
arc w/cover
```

Concrete Type Information:

-----strains-----				-----strength-----						
Type	e0	e2	ecc	eu	f0	f2	fcc	fu	E	w
1	0.0020	0.0040	0.0055	0.0155	5.20	6.86	7.02	5.81	4112	144
2	0.0020	0.0040	0.0020	0.0050	5.20	3.41	5.20	2.50	4112	144

Steel Type Information:

-----strains-----			--strength-			
Type	ey	eh	eu	fu	E	
1	0.0023	0.0150	0.0900	68.00	95.00	29000
2	0.0023	0.0075	0.0600	68.00	95.00	29000

Force Equilibrium Condition of the x-section:

Max. Conc. Strain	Max. Neutral Axis	Steel Strain	Steel Conc.	Steel force	P/S	Net Curvature Moment
				Page 1		

step	epscmax	ANOM68%.OUT										(k-ft)
		in.	Tens.	Comp.	Comp.	Tens.	force	force	rad/in			
0	0.00000	0.00	0.0000	0	0	0	0	0.00	0.000000	0	0	0
1	0.00031	1.60	-0.0003	442	119	-79	0	-0.24	0.000014	788		
2	0.00034	2.64	-0.0003	457	125	-100	0	0.09	0.000016	854		
3	0.00038	3.55	-0.0004	475	132	-126	0	-0.30	0.000019	927		
4	0.00042	4.34	-0.0005	496	141	-156	0	-0.07	0.000021	1008		
5	0.00046	5.04	-0.0006	521	151	-190	0	0.32	0.000024	1097		
6	0.00051	5.66	-0.0007	549	161	-228	0	-0.30	0.000028	1194		
7	0.00057	6.20	-0.0008	581	172	-271	0	0.08	0.000032	1303		
8	0.00063	6.66	-0.0009	616	185	-318	0	0.43	0.000036	1423		
9	0.00069	7.08	-0.0010	656	198	-372	0	-0.29	0.000041	1554		
10	0.00076	7.44	-0.0012	700	213	-431	0	0.06	0.000046	1700		
11	0.00085	7.76	-0.0014	749	229	-496	0	0.00	0.000052	1860		
12	0.00093	8.03	-0.0015	803	247	-568	0	-0.06	0.000059	2035		
13	0.00103	8.26	-0.0017	862	267	-648	0	-0.24	0.000066	2226		
14	0.00114	8.46	-0.0020	927	290	-735	0	-0.08	0.000074	2435		
15	0.00126	8.62	-0.0022	996	315	-829	0	-0.11	0.000082	2661		
16	0.00140	8.81	-0.0025	1065	341	-924	0	0.27	0.000092	2878		
17	0.00154	9.08	-0.0028	1126	366	-1010	0	0.12	0.000103	3058		
18	0.00171	9.44	-0.0032	1174	387	-1079	0	-0.31	0.000117	3185		
19	0.00189	9.73	-0.0037	1225	412	-1155	0	0.09	0.000132	3318		
20	0.00208	10.04	-0.0042	1269	440	-1227	0	0.44	0.000149	3431		
21	0.00230	10.37	-0.0048	1302	469	-1290	0	-0.16	0.000169	3513		
22	0.00255	10.62	-0.0055	1335	503	-1356	0	0.29	0.000191	3597		
23	0.00282	10.82	-0.0062	1366	543	-1426	0	0.09	0.000214	3681		
24	0.00311	10.97	-0.0070	1394	588	-1500	0	0.00	0.000239	3764		
25	0.00344	11.17	-0.0079	1406	632	-1556	0	-0.03	0.000268	3827		
26	0.00381	11.37	-0.0089	1408	682	-1609	0	-0.26	0.000301	3889		
27	0.00421	11.59	-0.0101	1399	734	-1652	0	0.02	0.000339	3944		
28	0.00465	11.67	-0.0113	1392	775	-1685	0	-0.02	0.000377	3973		
29	0.00514	11.67	-0.0125	1371	824	-1713	0	0.31	0.000417	3986		
30	0.00568	11.61	-0.0137	1344	875	-1736	0	0.13	0.000459	3990		
31	0.00628	11.48	-0.0149	1322	910	-1751	0	0.07	0.000502	3989		
32	0.00695	11.32	-0.0162	1319	922	-1760	0	-0.17	0.000548	3987		
33	0.00768	11.20	-0.0177	1330	927	-1776	0	0.15	0.000600	4004		
34	0.00849	11.11	-0.0194	1345	936	-1799	0	0.03	0.000659	4030		
35	0.00939	11.03	-0.0212	1361	945	-1823	0	0.34	0.000724	4062		
36	0.01038	10.97	-0.0233	1379	954	-1851	0	-0.01	0.000797	4098		
37	0.01147	10.90	-0.0256	1398	965	-1881	0	-0.16	0.000876	4138		
38	0.01268	10.84	-0.0281	1418	977	-1913	0	0.38	0.000964	4178		
39	0.01402	10.79	-0.0309	1435	997	-1949	0	0.07	0.001062	4224		
40	0.01550	10.74	-0.0339	1448	1019	-1986	0	-0.36	0.001169	4267		

First Yield of Rebar Information (not Idealized):

Rebar Number 1
 Coordinates X and Y (global in.) 3.39, -18.27
 Yield strain = 0.00230
 Curvature (rad/in)= 0.000085
 Moment (ft-k) = 2746

Cross Section Information:

Axial Load on Section (kips) = 482
 Percentage of Main steel in Cross Section = 3.32
 Concrete modulus used in Idealization (ksi) = 4112
 Cracked Moment of Inertia (ft^4) = 4.527

Idealization of Moment-Curvature Curve by Various Methods:

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Method ID	Conc. in/in	Points on Curve			Idealized values				
		Strain rad/in	Curv. (K-ft)	Moment rad/in	Yield Curv. moment	Moment (K-ft)	for curv.	symbol	Plastic rad/in
Strain @ 0.003	0.000229	3732	0.000116	3732	Mn	0.001053			
Strain @ 0.004	0.000320	3916	0.000122	3916	Mn	0.001047			
Strain @ 0.005	0.000406	3982	0.000124	3982	Mn	0.001045			
CALTRANS	0.00791	4012	0.000125	4012	Mp	0.001044			
UCSD@5phy	0.00527	3987	0.000124	3987	Mn	0.001045			

anom58%.out

```
*****
*          XSECTION
*
*      DUCTILITY and STRENGTH of
*      Beams, Columns, Piles, Shafts, Footings, and
*      Various Structural Sections
*      using Fiber Models
*
* VER._4.00,_APR-01-06
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* damages arising out of the use of this program.
*
* An appropriate license must be obtained for use of this
* software. For support please call 916-933-4863.
* For third party licensing please call the license issuing
* entity.
*
```

This output was generated by running:

```
XSECTION
VER._4.00,_APR-01-06
LICENSE (choices: LIMITED/UNLIMITED)
LIMITED
ENTITY (choices: GOVERNMENT/CONSULTANT)
CONSULTANT
NAME_OF_FIRM
ZIPPY_ENGINEERING
BRIDGE_NAME
ROCKET_AVE.
BRIDGE_NUMBER
123-456
JOB_TITLE
arc w/cover
```

Concrete Type Information:

Type	strains				strength				E	W
	e0	e2	ecc	eu	f0	f2	fcc	fu		
1	0.0020	0.0040	0.0055	0.0155	5.20	6.86	7.02	5.81	4112	144
2	0.0020	0.0040	0.0020	0.0050	5.20	3.41	5.20	2.50	4112	144

Steel Type Information:

Type	strains				strength	
	ey	eh	eu	fu	E	
1	0.0023	0.0150	0.0900	68.00	95.00	29000
2	0.0023	0.0075	0.0600	68.00	95.00	29000

Force Equilibrium Condition of the x-section:

Max.	Conc.	Neutral	Max.	Steel	Page	1

anom58%.out										
step	Strain epscmax	Axis in.	Strain Tens.	Conc. Comp.	force Comp.	P/S force	Net force	Curvature rad/in	Moment (K-ft)	
0	0.00000	0.00	0.0000	0	0	0	0.00	0.000000	0	
1	0.00031	-8.99	-0.0001	422	103	-43	0.18	0.000012	287	
2	0.00034	-7.84	-0.0001	433	107	-58	-0.14	0.000014	334	
3	0.00038	-6.85	-0.0002	447	112	-77	0.20	0.000016	386	
4	0.00042	-5.96	-0.0002	462	118	-99	0.01	0.000018	442	
5	0.00046	-5.19	-0.0003	481	126	-125	0.40	0.000021	504	
6	0.00051	-4.49	-0.0003	502	135	-156	-0.20	0.000024	572	
7	0.00057	-3.89	-0.0004	527	146	-190	0.42	0.000027	646	
8	0.00063	-3.35	-0.0005	554	156	-229	-0.31	0.000031	729	
9	0.00069	-2.88	-0.0005	585	169	-271	0.27	0.000035	819	
10	0.00076	-2.46	-0.0006	620	182	-319	-0.11	0.000039	918	
11	0.00085	-2.09	-0.0007	658	196	-373	-0.07	0.000044	1027	
12	0.00093	-1.77	-0.0008	701	212	-432	0.10	0.000050	1146	
13	0.00103	-1.49	-0.0009	748	230	-497	-0.22	0.000056	1277	
14	0.00114	-1.25	-0.0011	801	250	-568	0.29	0.000063	1420	
15	0.00126	-1.04	-0.0012	857	272	-647	-0.23	0.000070	1575	
16	0.00140	-0.87	-0.0014	918	296	-733	-0.06	0.000078	1744	
17	0.00154	-0.73	-0.0015	984	324	-826	-0.24	0.000087	1926	
18	0.00171	-0.62	-0.0017	1055	355	-927	0.36	0.000097	2121	
19	0.00189	-0.53	-0.0019	1130	389	-1037	-0.10	0.000108	2330	
20	0.00208	-0.48	-0.0021	1209	428	-1155	0.00	0.000119	2552	
21	0.00230	-0.45	-0.0024	1290	472	-1281	-0.27	0.000132	2785	
22	0.00255	-0.27	-0.0027	1349	514	-1380	0.43	0.000148	2956	
23	0.00282	-0.10	-0.0030	1404	559	-1480	0.32	0.000165	3121	
24	0.00311	0.19	-0.0034	1434	600	-1552	-0.09	0.000186	3233	
25	0.00344	0.51	-0.0039	1452	642	-1611	0.38	0.000209	3321	
26	0.00381	0.72	-0.0044	1478	675	-1670	-0.06	0.000234	3398	
27	0.00421	0.87	-0.0050	1508	705	-1732	-0.39	0.000261	3468	
28	0.00465	0.90	-0.0055	1549	713	-1780	0.06	0.000289	3503	
29	0.00514	0.94	-0.0062	1571	720	-1808	0.21	0.000321	3504	
30	0.00568	0.94	-0.0068	1587	732	-1836	0.44	0.000355	3493	
31	0.00628	1.02	-0.0076	1582	737	-1837	0.05	0.000394	3466	
32	0.00695	1.09	-0.0085	1589	743	-1850	0.13	0.000437	3471	
33	0.00768	1.14	-0.0094	1596	750	-1865	-0.12	0.000485	3483	
34	0.00849	1.17	-0.0104	1609	761	-1888	-0.31	0.000538	3510	
35	0.00939	1.20	-0.0116	1625	773	-1916	-0.08	0.000595	3547	
36	0.01038	1.21	-0.0128	1640	787	-1945	0.08	0.000659	3586	
37	0.01147	1.22	-0.0142	1653	804	-1975	-0.07	0.000729	3625	
38	0.01268	1.25	-0.0157	1663	824	-2005	-0.18	0.000807	3671	
39	0.01402	1.27	-0.0174	1672	849	-2038	0.23	0.000893	3721	
40	0.01550	1.29	-0.0193	1678	880	-2076	0.42	0.000989	3778	

First Yield of Rebar Information (not Idealized):

Rebar Number 15
 Coordinates X and Y (global in.) -3.53, -18.24
 Yield strain = 0.00230
 Curvature (rad/in)= 0.000129
 Moment (ft-k) = 2734

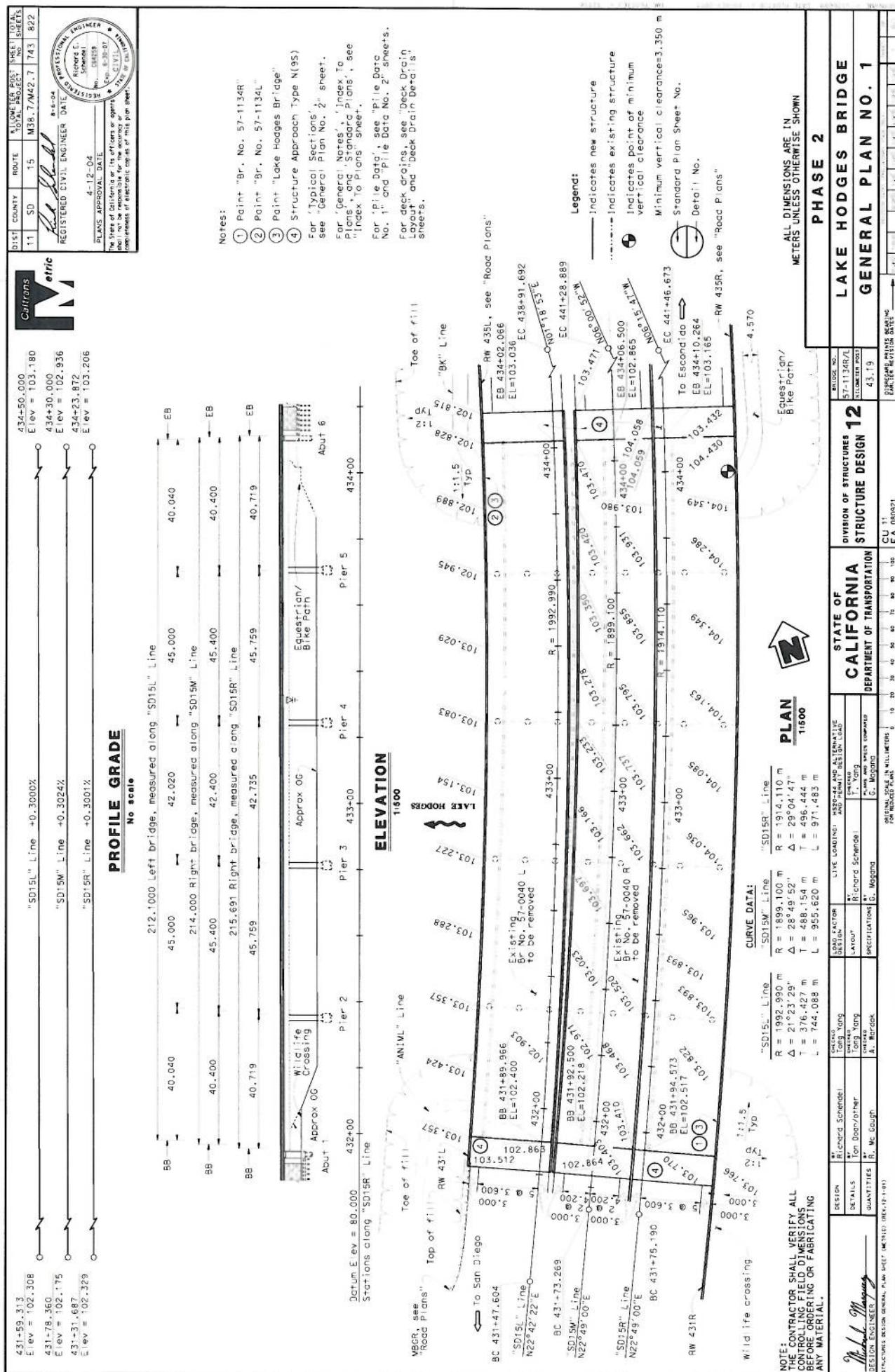
Cross Section Information:

Axial Load on Section (kips) = 482
 Percentage of Main steel in Cross Section = 3.32
 Concrete modulus used in Idealization (ksi) = 4112
 Cracked Moment of Inertia (ft^4) = 2.975

Idealization of Moment-Curvature Curve by Various Methods:

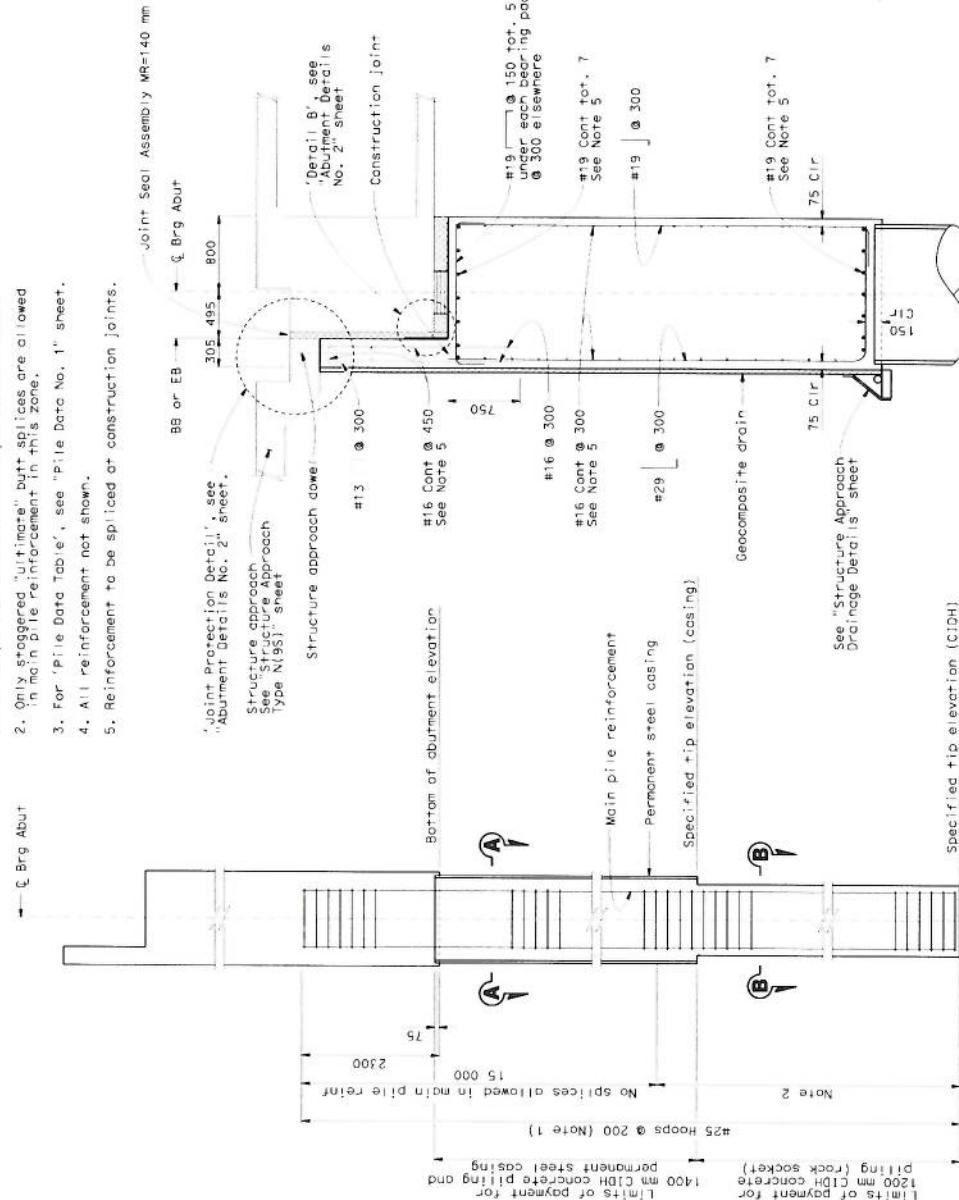
anom58%.out

Method ID	Conc. in/in	Points on Curve			Idealized values				
		Strain rad/in	Curv. (K-ft)	Moment (K-ft)	Yield Curv. rad/in	Moment (K-ft)	symbol for moment	Plastic Curv. rad/in	
Strain @ 0.003	0.000178		3190	0.000151	3190	Mn	0.000838		
Strain @ 0.004	0.000247		3432	0.000162	3432	Mn	0.000826		
Strain @ 0.005	0.000312		3504	0.000166	3504	Mn	0.000823		
CALTRANS	0.00965	0.000612	3557	0.000168	3557	Mp	0.000820		
UCSD@Sphy	0.01019	0.000647	3579	0.000169	3579	Mn	0.000819		



• 25

1. All hoops are "ultimate" butt spliced continuous.
 2. Only staggered "ultimate" butt splices are allowed in main tie reinforcement in this zone.
 3. For "Pile Data Tab.", see "Pile Data No. 1" sheet.
 4. All reinforcement to be spliced at construction joints.
 5. Reinforcement to be spliced or construction joints.



TYPICAL ABUTMENT SECTION

ELEVATION

卷之三

MAXIMUM LIMITS OF STAGE 1 REMOVAL

PHASE 2

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

PHASE 2

PHASE 2

LAKE HODGES BRIDGE
ABUTMENT DETAILS NO. 1

APPENDIX D

OVERHEAD SIGN 19, ROUTE 580 (ID-12) BACKUP DOCUMENTATION

1. Geotechnical Foundation Assessment of Pile foundation
2. Additional Pile Analysis Results
3. Additional As-built plans

M e m o r a n d u m*Flex your power!
Be energy efficient!*

To: **TONY MARQUEZ**
Deputy Division Chief
Structure Design
Division of Engineering Services

Date: October 25, 2011

File: 04-ALA-580-PM 36.2
Overhead Sign 19
EA 04-0A8004

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services – MS 5
Office of Geotechnical Design – North

Subject: Foundation Assessment of Overhead Sign (OHS) 19

Introduction

The Office of Geotechnical Design North was requested to assess the axial capacity for the foundation of Overhead Sign 19 located in Alameda County on Route 580 at ~~approximately~~ **postmile (PM) 36.2**. Based on the Pile Data Form dated June 2, 2009, gamma-gamma testing was performed on the OHS 19 which indicated two anomalies in the pile foundation. The two anomalies were reported at a depth of 8.8 to 9.2 meters and 9.2 meters to the pile tip.

A site visit and subsurface investigation was not performed for the foundation assessment. The ground surface elevation near OHS 19 was obtained from Google Earth and is considered to be approximate. For a reference, the elevation on the As-Built General Plan (GP) at the Golf Links Road UC (Br. No. 33-0354) was compared to the Google Earth elevation and it was very similar, a difference of less than 0.6 meters (2 feet). The Golf Links Road UC (Br. No. 33-0354) is approximately 0.16 kilometers (0.1 mile) away from the OHS 19 location.

This Office has evaluated the axial capacity of the overhead sign by using the following references:

- The Geotechnical Recommendations for Overhead Sign 19 Report dated April 25, 2005 by Tung Nguyen of the Office of Geotechnical Design-West (OGD-W).
- A Memorandum addressing the Groundwater Level dated August 29, 2005 by Tung Nguyen of OGD-W.
- Overhead Sign Details sheet for OHS 19 dated November 6, 2006.
- As-Built Log of Test Boring (LOTB) for Golf Links Road Undercrossing (Br. No. 33-0354) dated September 17, 1962.
- As-Built General Plan for Golf Links Road Undercrossing (Br. No. 33-0354) dated September 17, 1962.

- As-Built LOTB for 106th Avenue Undercrossing (Br. No. 33-0355) dated September 17, 1962.
- As-Built General Plan for 106th Avenue Undercrossing (Br. No. 33-0355) dated September 17, 1962.
- Wagner, D.L. and Bortugno, E. J., 1990, Geologic Map of the San Francisco-San Jose quadrangle, California, 1:250,000: California Division of Mines and Geology, Regional Geologic Map 5A.
- Ensoft SHAFT 6.0 for Windows, 2007.
- Source: "Oakland, CA." 37°45'03.51"N and 122°09'05.18W. Google Earth. December 1, 2009. October 25, 2011.
- A phone conversation with the Designer, K.C. Liu on October 24, 2011.
- Pile Design Data Form dated June 2, 2009.

As-Built Information

Based on the As-Built plans, OHS 19 was constructed in 2008 or 2009. The pile foundation for the OHS is shown on the plan as a 1524 mm (60 in) x 10.06 m (33.0 ft) Cast-In-Drilled-Hole (CIDH).

Geology

Based on the Geologic Map of the San Francisco-San Jose quadrangle (1990), the area is mapped as consisting of alluvium and volcanic rock-rhyolite. According to the As-Built LOTB for nearby Golf Links Road UC (Br. No. 33-0354), a subsurface investigation was performed during July 1961. The material encountered on the slope near the OHS 19 location was weathered fractured rhyolite (volcanic rock). Upon viewing Google Earth photos it also appears the cut slope near the OHS 19 likely consists of volcanic rock.

Foundation Assessment

The assumptions for the calculations were based on the references listed above in the introduction portion of this report. Based on Google Earth we estimated the top of ground elevation at 52.4 meters (172 feet) near OHS 19. The soil parameters used for the calculations were obtained from the Geotechnical Recommendations for Overhead Sign Report dated April 25, 2005. This report used nearby borings and local geology to provide that the foundation soils meet or exceed an internal friction angle of 30 degrees and a unit weight of 1922 kg/m³ (120pcf). Based upon the limited data gathered during our research for this report we concur with the April 25, 2005 assessment. These parameters were used as input for our analyses. A groundwater elevation of 44.2 meters (145 feet) was reported in the Memorandum addressing the Groundwater Level dated August 29, 2005. Since gamma-gamma logging was performed on the CIDH pile, we also performed an analysis with groundwater assumed to be at the surface. Gamma-gamma testing is typically performed on a foundation when the pile is constructed using wet conditions.

Tony Marquez
October 25, 2011
Page 3

Foundation Assessment of Overhead Sign (OHS) 19
EA# 04-0A8004

Based on our calculations, we estimated the axial capacity for the CIDH pile from the ground surface (estimated at elevation 52.4 meters) to the top of the first anomaly section B-B (depth 8.8 meters to 9.2 meters) as approximately 3452 kN (388 tons) utilizing skin friction only; groundwater was considered at elevation 44.2 meters. We performed the same analysis with groundwater assumed to be at the ground surface (worst case scenario). The estimated axial capacity was approximately 1672 kN (188 tons).

According to the Designer, K.C. Liu, an axial compressive demand of 74.7 kN (16.8 kips or 8.4 tons) is required for the CIDH pile foundation for the OHS 19. Based on our calculations the axial capacity of the CIDH pile for OHS 19 whether groundwater is at elevation 145 feet or at the ground surface (elevation 52.4 meters), exceeds the axial compressive demand.

If there are additional questions concerning this Memorandum please contact Reid Buell at (916) 227-1012, Tim Alderman at (916) 227-1035 or Jacqueline Martin at (916) 227-1051.



TIM ALDERMAN
Engineering Geologist
Office of Geotechnical Design-North



JACQUELINE A MARTIN
Engineering Geologist
Office of Geotechnical Design-North

Reid Buell
REID BUELL.
Senior Engineering Geologist
Office of Geotechnical Design-North

EA 04-0A8004 Overhead Sign 19

Background: Sign No. 19 is a single post tubular sign structure supported on a 1.524 meters (5 feet) diameter by 10.06 meters (33 feet) deep CIDH concrete pile.

Section B-B Pile Anomaly @ 8.8 meters (28.9 feet): Per Pile Design Data Form, up to 20% of pile cross-section might be affected. Based on foundation assessment provided by Geotechnical Services, the capacity, demand, and factor of safety are listed in the table below.

Section B-B	Capacity	Demand	Factor of Safety
Shear (SI Metric Units)	450 kN	62 kN	7
Shear (U.S. Customary Units)	101 kips	14 kips	7
Bending Moment (SI Metric Units)	4048 kN-m	45 kN-m	90
Bending Moment (U.S. Customary Units)	2986 kip-ft	33 kip-ft	90

Section C-C Pile Anomaly @ 9.2 meters (30.1 feet): Per Pile Design Data Form, up to 40% of pile cross-section might be affected. Based on foundation assessment provided by Geotechnical Services, the capacity, demand, and factor of safety are listed in the table below.

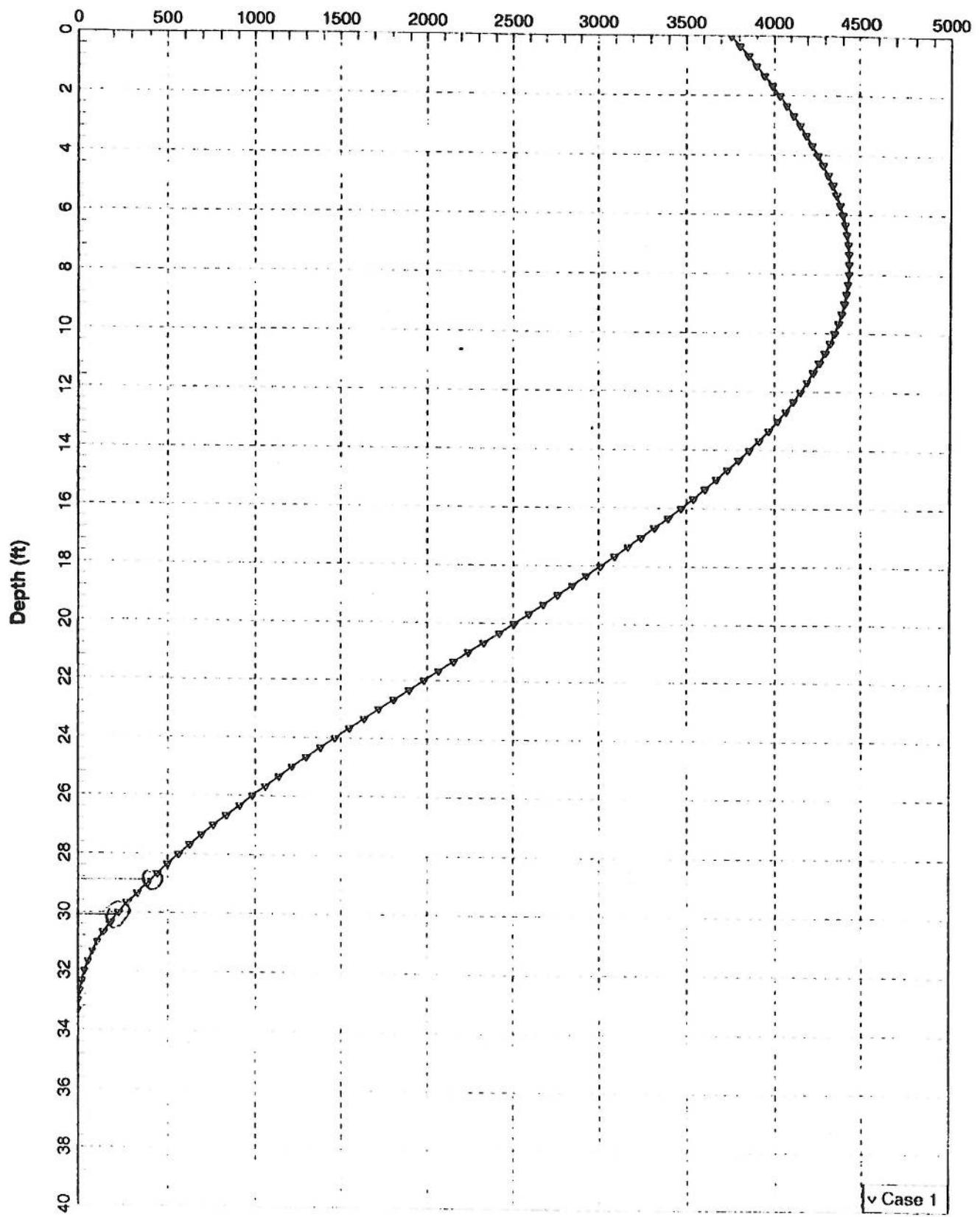
Section C-C	Capacity	Demand	Factor of Safety
Shear (SI Metric Units)	216 kN	49 kN	4
Shear (U.S. Customary Units)	49 kips	11 kips	4
Bending Moment (SI Metric Units)	1993 kN-m	28 kN-m	70
Bending Moment (U.S. Customary Units)	1470 kip-ft	21 kip-ft	70

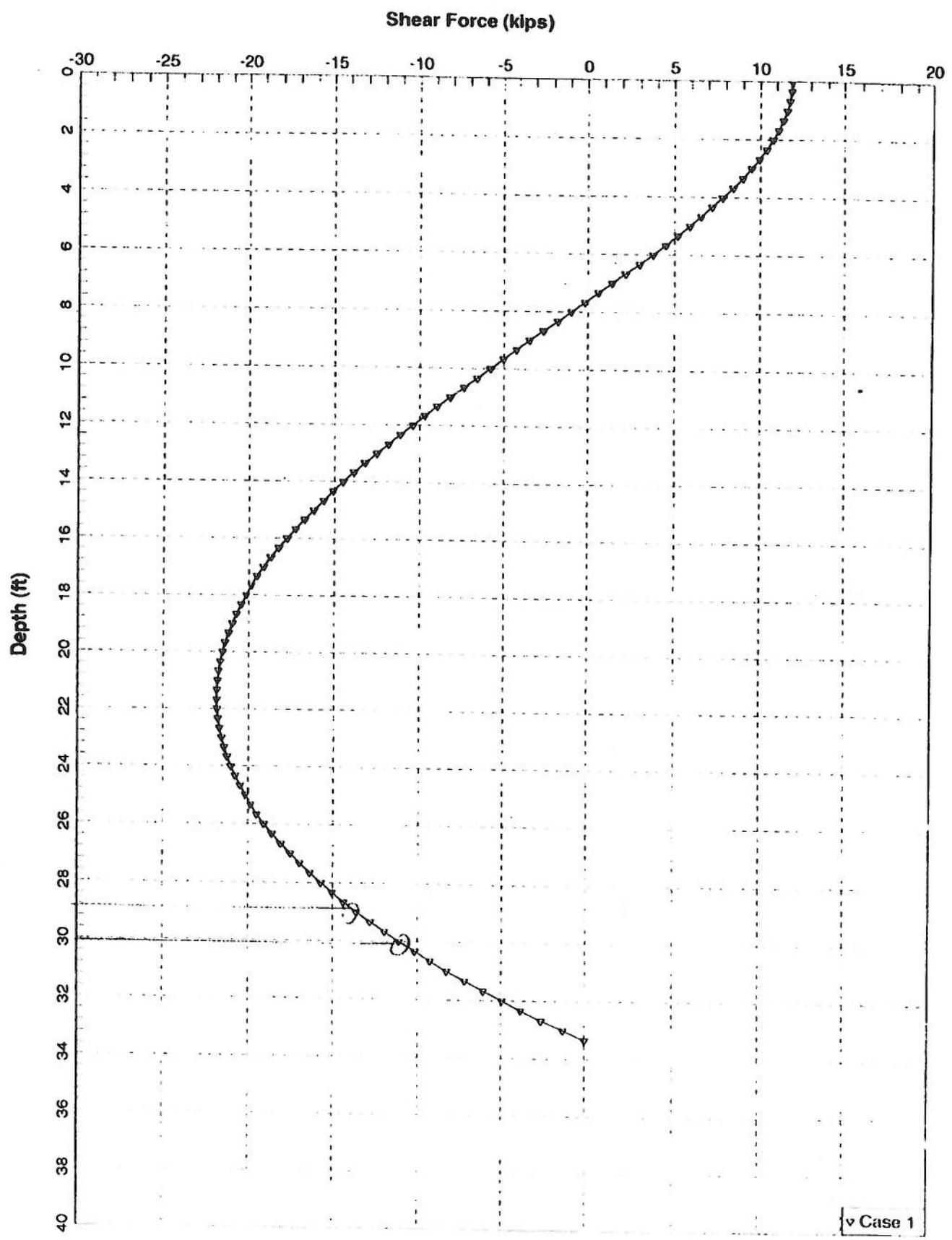
Recommendation: Based on the analysis and factor of safety listed above, the pile is structurally adequate.



K.C. Liu
Registered P.E. (Civil) No. C50291
Caltrans -- DES – ODT'S
Signs & OH Structures
PS&E Specialist

Bending Moment (in-kips)





S - 14

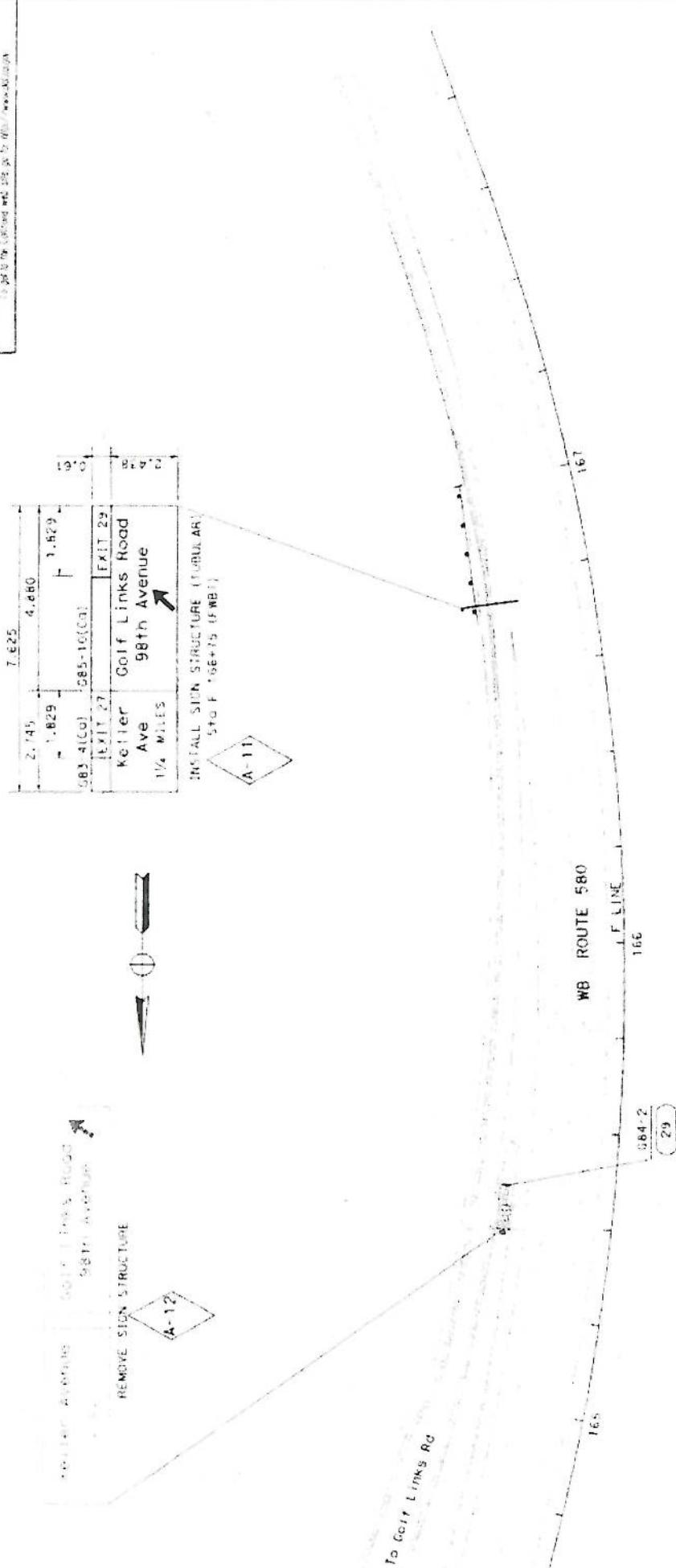
ALL DIMENSIONS ARE IN
METERS UNLESS OTHERWISE SHOWN
SIGN PLAN
(LOCATION 19)
NO SCALE

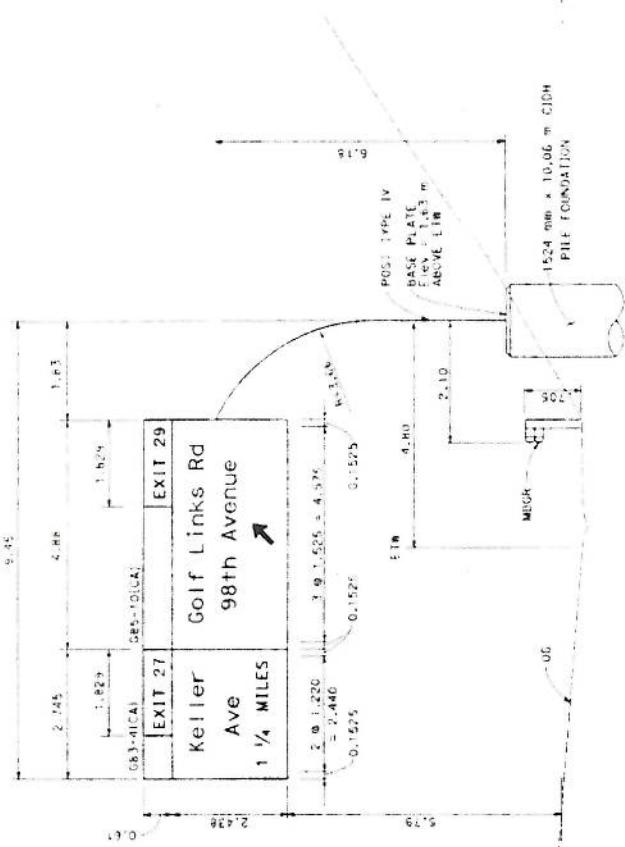
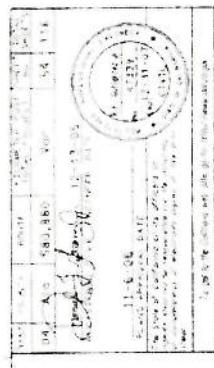
THIS PLAN ACCURATE FOR SIGN WORK ONLY
FOR NOTES, ABBREVIATIONS & OTHER
LEGEND, SEE SHEET S-1

11-12-11
9002-104-2600
11-12-11
9002-104-2600

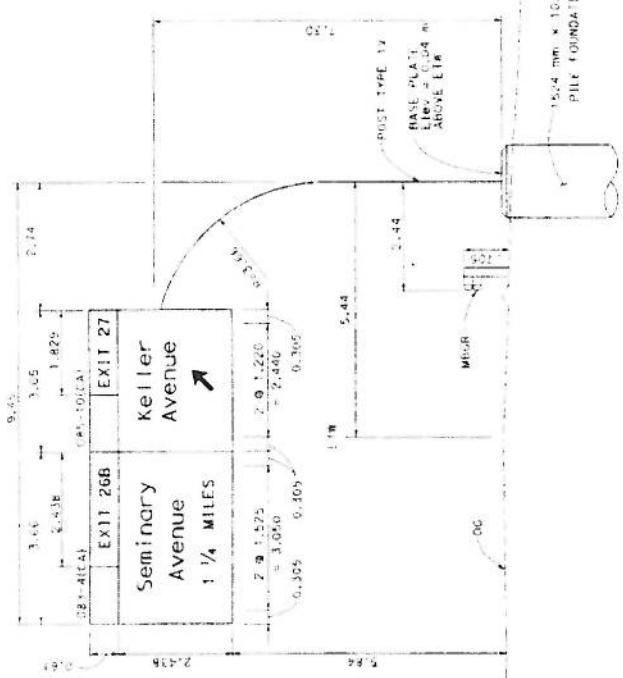
FA. DRAWING

CU. 04250





Sta F 166 + 00 (FWBT)
LOCATION 19



Sta F 144 + 00 (FWBT)
LOCATION 20

OVERHEAD SIGN DETAILS

NO SCALE
SD - 8

ALL DIMENSIONS ARE IN
METERS UNLESS OTHERWISE SHOWN

1524 mm x 1006 m C10H
POST TYPE IV
LEV = 0.04 m
ABOVE EIA

1524 mm x 1006 m C10H
POST TYPE IV
LEV = 0.04 m
ABOVE EIA

1524 mm x 1006 m C10H
POST TYPE IV
LEV = 0.04 m
ABOVE EIA



Dist. Count*	Route	Post Miles	Total Miles	Total Dist.
Total 15				
Total 15, See Table				

B. L. [Signature]

RESIDENTIAL CIVIL ENGINEER

DATE: MARCH 1, 2006

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
DIVISION OF ENGINEERING
DIVISION OF CONSTRUCTION
DIVISION OF TRAFFIC
DIVISION OF HIGHWAY MAINTENANCE
DIVISION OF HIGHWAY CONSTRUCTION
DIVISION OF HIGHWAY RESEARCH
DIVISION OF HIGHWAY PLANNING
DIVISION OF HIGHWAY SAFETY
DIVISION OF HIGHWAY POLICIES
DIVISION OF HIGHWAY INVESTIGATION
DIVISION OF HIGHWAY INSPECTION
DIVISION OF HIGHWAY POLICE
DIVISION OF HIGHWAY POLICE TRAINING
DIVISION OF HIGHWAY POLICE TRAINING

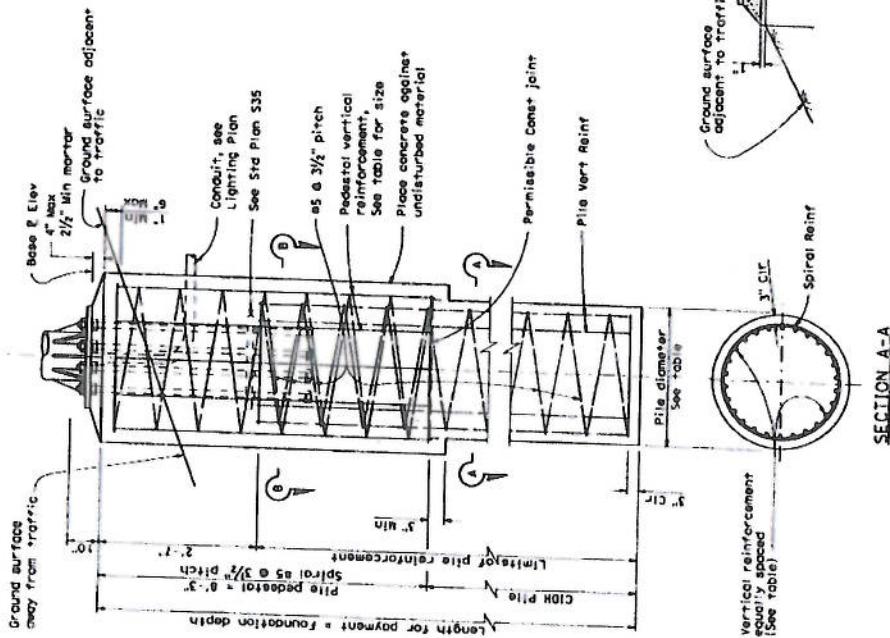
To file in the Office and file in the [redacted] www.dft.ca.gov

Post Type No.	Bolt Circle Dia	Total Circle Dia and Dia Length	Round Pile Pedestal Vertical Reinforcement		Spiral Dia	C/IW Pile	Reinforcing Bar Size	Bar Pitch	Pile Dia	Vertical Total Dia	Spiral Dia	Foundation Depth
			Bar Size	Total Length								
I	2'-5"	14'-2"	4'-2"	5'-6"	16	#5	3/8"	5'-0"	28	9-11	65	3 1/2'
II	2'-10"	14'-2"	5'-0"									25'-0"
III	3'-4"	16'-2"										25'-0"
IV	3'-4"	16'-2"										33'-0"
V	3'-4"	16'-2"										33'-0"

* Use Foundation Depth shown in Table unless otherwise shown on the Project Plans.

NOTES:

1. For anchor bolt layout, see Standard Plan S35.
2. For "base & elevation", see Project Plans.
3. Prior to erection of the post, backfill which is equivalent to the surrounding material, shall be placed.
4. Pedestal shall be formed 6" minimum below ground surface. Remind to be placed against undisturbed material.
5. Slope protection required when indicated on the Project Plans.
6. Foundation design is based on 2001 ASHTO article 13.6 Brane. The angle of internal friction is 30 degrees. The cohesionless material weight of soil used is 120 lb/ft³.



STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
**OVERHEAD SIGNS-TUBULAR
SINGLE POST AND TWO POST TYPE
ROUND PEDESTAL PILE FOUNDATION**
NO SCALE

S37

APPENDIX E

SAWTELL BLVD UC, RETAINING WALL 435B (ID-18) BACKUP DOCUMENTATION

1. Designer's Structural Assessment Memo & Analysis Results
2. Additional As-built plans

Memorandum

*Flex your power!
Be energy efficient!*

To: BARTON NEWTON
State Bridge Engineer
Division of Engineering Services

Date: March 30, 2012

From: GERRARD HIGHT
Senior Bridge Engineer
Structure Policy & Innovation
Division of Engineering Services

Subject: Retaining Wall 435B

This memo details the analysis of retaining wall section number 9 of Retaining Wall 435B using the final as built plans.

The Original design of the retaining wall foundations was changed through Contract Change Order # 53 of contract number 07-1178U4 from driven concrete piles to 24" diameter CIDH piles due to the vibration sensitivity of a large diameter water main running under the retaining wall. The 24" diameter CIDH piles were sized to 625 kN (140 kip) vertical load capacity and 116kN (26 kip) lateral capacity. The water table at the site was high enough that the 24" CIDH piles were built in wet hole conditions. Gamma-Gamma Log testing was performed on all piles by the Foundation Testing Branch.

Section no. 9 of the retaining wall consists of sixty eight (68) 24" diameter piles in 4 rows of 17 piles each. The analysis of the piles loads was performed with both Working Stress Design (WSD) and Load and Resistance Factor Design (LRFD) and the pile loads were found to be less than the capacity of the piles in both cases.

Summary of Controlling Load Cases (68 piles):

LOAD CASE	DESCRIPTION	LOAD (kips)	CAPACITY (kips)	RATIO	
SERVICE LOADS	TOTAL LATERAL LOAD	1463	1768	1.21	O.K.
	MAX HEEL LOAD	17	140	8.24	O.K.
	MAX TOE LOAD	60	140	2.32	O.K.
FACTORED LOADS (LRFD)	TOTAL LATERAL LOAD	2217	2652	1.20	O.K.
	MAX HEEL LOAD	16	196	12.60	O.K.
	MAX TOE LOAD	83	196	2.36	O.K.

FILE

October 21, 2011

Page 2 of 2

The following analysis assumes that pile #69 and pile #72 (as numbered for GGL testing) located in rows 3 and 4 respectively are removed from the analysis. The removal of two piles leaves a total of 66 piles, 17 in row 1, 17 in row 2, 16 in row 3, and 16 in row 4.

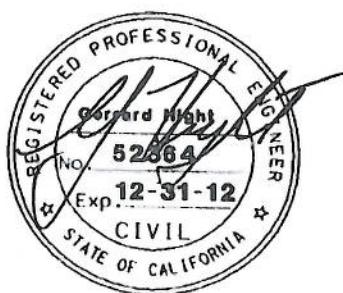
Summary of Controlling Load Cases (66 piles):

LOAD CASE	DESCRIPTION	LOAD (kips)	CAPACITY (kips)	RATIO	
SERVICE LOADS	TOTAL LATERAL LOAD	1463	1716	1.17	O.K.
	MAX HEEL LOAD	18	140	7.63	O.K.
	MAX TOE LOAD	60	140	2.33	O.K.
FACTORED LOADS (LRFD)	TOTAL LATERAL LOAD	2217	2574	1.16	O.K.
	MAX HEEL LOAD	17	196	11.53	O.K.
	MAX TOE LOAD	83	196	2.36	O.K.

The removal of two piles increases the loads on the rest of the piles, but the minimum factor of safety calculated to be 1.16 for lateral loads remains above the minimum required of 1.0. Since pile # 69 and pile # 72 are located at the rear of the pile group the vertical loads applied to these piles are minimal. The maximum load on the rear piles is 18kips which is well below the design capacity of 140 kips

After running the analysis in several different ways and using different programs, it is my opinion that the loss of two (2) piles does not affect the safety or functionality of the structure.

Gerrard Hight
Senior Bridge Engineer



Cc:File



Special design retaining wall = 21.602 [Measured along R/TOL]

ECONOMIC TIDES AND POLITICAL PARTIES

Section 6 Section 7 Section 8 Section 9 Section 10 Section 11 Section 12 Section 13

116 spaces at .1250 = 20.00

species @ 1.250 = 20.00

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1057

卷之三

卷之三

100

卷之三

卷之三

卷之三

dk
0029

卷之三

MARIANNE MAYER

1180

CONTENTS

SHEE

STATE OF
NEW YORK

STRUCTURE DESIGN

CONTRACT CHANGE ORDER NO. _____

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

STRUCTURE PLAN NO. 3
RETTAINING WALL NO. 435B

NOTE: CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.

SECTION	W	B	C	PLATE THICKNESS	PLATE SPACING	PLATE LENGTH	PLATE WIDTH	PLATE WEIGHT
1	9400	2300	1500	10 mm	400 mm	47.64 m	0.5 m	10.4 t
2	9400	1200	6100					
3	9200	4000	5200					
4	9800	4900	4300					
5	12000	6500	1500					
6	9500	7400	1700					
7	7600	1100	5700					

DESIGN DATA

DESIGN: Load Factor Design (LFD)

CONCRETE: Reinforced Concrete, f'c = 25 MPa

LOADING CASE:

Level: Ground with 11.5 kPa live load surcharge and 48.5 kN/m Soundwall

Seismic Load:

- Dead Load: 5.1 kN/m
- Dead Load of Soundwall: 5.1 kN/m
- Dead Load of Barrier: 5.4 kN/m

SEISMIC LOAD: SOIL:

Kn = 0.55

Kv = 0.0

Kce = Mononobe-Okabe Method

SOC: G = 24° Y = 19 kNm/m³

Equivalent Fluid Pressure:

STATIC: 5.1 kN/m² for determination of toe pressure

SEISMIC: Coulomb's Theory

LOAD COMBINATIONS:

75% Earth Pressure:

Loadings 1: Bd + 0.75e(1.9 E) + 0.75w(1.0 Pcw) + 0.75 v

Loadings 2: Bd + 0.75e(1.7 E) + 0.75w(1.7 Pcw) + 0.75 v

100% Earth Pressure:

Group A1: Bd + 1.7 E + 1.7 Sc + 0.75 T

Group A2: Bd + 1.7 E + 1.7 Sc + 0.75 T

Group B1: Bd + 1.7 E + 1.7 Pv + 0.75 T

Group B2: Bd + 1.7 E + 1.7 Pv + 0.75 T

Group C1: Bd + 1.0 D + 1.0 E + 1.0 Fcd + 1.0 Fce

Posting: Bd + 0.75w(1.0 Pcw) + 0.75 v

Where: Bd = Dead Load
E = Earth Pressure
Sc = Live Load Surcharge
T = Wind Load
Pcw = Seismic Dead Load Coefficient
Fcd = Seismic Lateral Earth Pressure
Pnw = Probable Yield Moment
(1.3 x Nominal Yield Moment of Stem)
V = Possible Shear or Base or Stem Moment
associated with Probable Yield Moment
T = Design Force for Vertical Lateral

CONFIGURATION 1 (SECTIONS 1-6)

No Scale

Row 1 Row 2 Row 3 Row 4

150mm Exc. PC Styrene

Row 1 Row 2 Row 3 Row 4

150mm Exc. PC Styrene

CONFIGURATION 2 (SECTION 7)

No Scale

Row 1 Row 2 Row 3 Row 4

450 915 Varieties 315 450

Top of wall

Notes:

- 1) Bundle ④ and ③ Bars.
- 2) Splice ④ Bar to ④ and ⑤ Bars
- 3) Cont = Continuous

ELEVATION

No Scale

Section of 19

CLASS 400 CIDH AND 600 mm CIDH PILE FOOTING SECTION

No Scale

Section of 19

REvised FOOTING & PILES

GH 1.2 SD

CONTRACT CHANGE ORDER NO. _____

RETAINING WALL NO. 435B

All dimensions are in MILLIMETERS UNLESS OTHERWISE SHOWN

SPECIAL DESIGN RETAINING WALL DETAILS

STRUCTURE DESIGN 18 N/A

DEPARTMENT OF TRANSPORTATION 53.414

STATE OF CALIFORNIA N/A

DEPARTMENT OF TRANSPORTATION

CLJ 67 EA 1101

REvised Retaining Wall Details Sheet No. 1

APPENDIX F

BRADDOCK DR. UC, BR. NO. 53-1258, ABUT 1RETAINING WALL (ID-52) BACKUP DOCUMENTATION

- 1. Designer's Structural Assessment Memo & Analysis Results**
- 2. Additional As-built Plans**

Memorandum

*Flex your power!
Be energy efficient!*

To: BARTON NEWTON
State Bridge Engineer
Division of Engineering Services

Date: October 21, 2011

From: GERRARD HIGHT
Senior Bridge Engineer
Structure Policy & Innovation
Division of Engineering Services

Subject: Braddock Drive UC (Widen) Abutment 1 Right Retaining Wall Section 4, Br. No. 53-1258

This memo details the analysis of retaining wall section number 4 of the Braddock Dr. UC (Widen) at abutment 1 right.

The Original design of the retaining wall and abutment foundations was changed through Contract Change Order # 53 of contract number 07-1178U4 from driven concrete piles to 24" diameter CIDH piles due to the vibration sensitivity of a large diameter water main and a sewer line running under the abutment and retaining wall. The 24" diameter CIDH piles were sized to 625 kN (140 kip) vertical load capacity and 116kN (26 kip) lateral capacity. The water table at the site was high enough that the 24" CIDH piles were built in wet hole conditions. Gamma-Gamma Log testing was performed on all piles by the Foundation Testing Branch.

Section no. 4 of the retaining wall consists of sixteen (16) 24" diameter piles in 4 rows of 4 piles each. The analysis of the piles loads was performed with both Working Stress Design (WSD) and Load Factor Design (LFD) and the pile loads were found to be less than the capacity of the piles.

Summary of Controlling Load Cases using WSD (16 piles):

GRP	CA	DESCRIPTION	LOAD	CAP	RATIO	
IH	1	TOTAL LATERAL LOAD	195.	416.	2.13	OK
II	2	MAX HEEL LOAD	89.	140.	1.57	OK
IH	1	MAX TOE LOAD	107.	140.	1.31	OK

Summary of Controlling Load Cases using LFD (16 piles):

GRP	CA	DESCRIPTION	LOAD	CAP	RATIO	
IV	1	TOTAL LATERAL LOAD	328.	492.	1.50	OK
IP	2	MAX HEEL LOAD	117.	210.	1.80	OK
IV	1	MAX TOE LOAD	143.	210.	1.47	OK

FILE

October 21, 2011

Page 2 of 3

The following analysis assumes that piles 50 and 51 (as numbered for GGL testing) located in rows 4 and 3 respectively were rejected and not replaced; therefore they are removed from the analysis. The removal of two piles leaves a total of 14 piles, 4 in row 1, 4 in row 2, 3 in row 3, and 3 in row 4.

Summary of Controlling Load Cases using WSD (14 piles):

GRP	CA	DESCRIPTION	LOAD	CAP	RATIO
IH	1	TOTAL LATERAL LOAD	195.	364.	1.87 OK
II	2	MAX HEEL LOAD	121.	140.	1.16 OK
IH	1	MAX TOE LOAD	105.	140.	1.33 OK

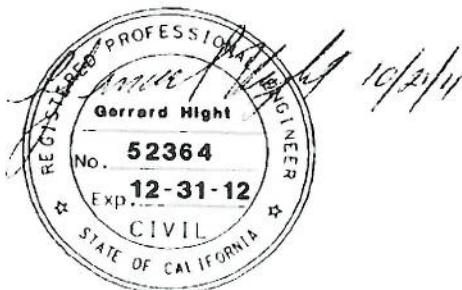
Summary of Controlling Load Cases using LFD (14 piles):

GRP	CA	DESCRIPTION	LOAD	CAP	RATIO
IV	1	TOTAL LATERAL LOAD	328.	431.	1.31 OK
IP	2	MAX HEEL LOAD	159.	210.	1.32 OK
IV	1	MAX TOE LOAD	140.	210.	1.50 OK

The removal of two piles increases the loads on the rest of the piles, but the minimum factor of safety calculated to be 1.16 remains above the minimum required of 1.0.

After running the analysis in several different ways and using different programs, it is my opinion that the loss of two (2) piles does not affect the safety or functionality of the structure.

Gerrard Hight
Senior Bridge Engineer



NOTE: FOR COMPLETE R/W AND ACCURATE ACCESS DATA, SEE R/W RECORD MAPS
AT DISTRICT OFFICE.

אַלְמָנָה כְּלִילָה:

A circular library stamp with the text "LEEN KLO" at the top and "32651" at the bottom. A barcode is visible in the center.

ALL DIMENSIONS ARE IN METERS
UNLESS OTHERWISE SHOWN
LAYOUT
SCALE 1:500

8

